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[NABOKOV (V. A.) & ZAV'YALOV (A. P.).] **Набоков (В. А.) и Завьялов (А. П.). Some Points in the Organisation of Control of Anopheline Larvae in Reservoirs.** [*In Russian.*]—*Med. Parasitol.* **11** no. 1–2 pp. 6–8. Moscow, 1942. [Recd. 1943.]

Artificial reservoirs that are formed in the Russian Union by impounding the waters of a number of streams usually provide favourable breeding places for malaria mosquitos [*Anopheles maculipennis*, Mg.], since the edges are irregular, with many inlets and much shallow water, and easily become overgrown with vegetation, which is mostly protected by the nature of the shoreline from the effects of wind and waves. The best method of dusting such areas to kill the larvae varies with local conditions. If aircraft are to be used, sketches should be prepared beforehand of the surfaces to be treated, since these vary during the season and much material and labour may otherwise be wasted. If the strip of infested water is narrow, dusting from aircraft is uneconomic and treatment from boats is to be preferred, unless the area is difficult of access. The various types of boats required for the transport of dusting machines, personnel, materials, etc., are briefly discussed.

[LARYUKHIN (M. A.).] **Ларюхин (М. А.). Duration of toxic Action of Oil-impregnated Dusts on Anopheline Larvae.** [*In Russian.*]—*Med. Parasitol.* **11** no. 1–2 pp. 8–14, 9 refs. Moscow, 1942. [Recd. 1943.]

In the laboratory and field experiments described, which were carried out in Moscow in 1937 and 1938, no increase in the time for which dusts of Paris green and a carrier continued to kill Anopheline larvae was obtained by adding various quantities of mineral oil to the mixed dusts or to the carriers before the mixtures were made [*cf. R.A.E.*, B **21** 180; **22** 138]. Impregnation with more than 5 per cent. oil definitely reduced the larval mortality, since it caused the particles to stick together, so that the larvae could not ingest them. The unoiled dusts gave complete mortality within 24 hours in the field when applied at the rate of 0·9 lb. Paris green per acre, but the water was reinfested 2–3 days later. In supplementary field experiments in 1940, Arsmal [copper arsenite adsorbed on chalk (*cf.* **22** 37)] with 2½ per cent. acidol [*cf.* **28** 8] and peat dust (1 : 19) applied at a rate equivalent to 0·9 lb. Arsmal per acre also killed all the larvae in 24 hours and retained its effectiveness for 2 days.

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[Laryukhin (M. A.).] **Ларюхин (М. А.). Experiments with Paris Green Suspension in the Control of Anopheline Larvae.** [*In Russian.*]—*Med. Parasitol.* **11** no. 1–2 pp. 14–22, 13 refs. Moscow, 1942. [Recd. 1943.]

Spraying against Anopheline larvae with suspensions of Paris green and kerosene in water, as recommended by Barber, Rice & Mandekos [*R.A.E.*, B **24** 289], has given good results in the Russian Union [*cf.* **28** 7, 37], but the mixtures tend to break up and require frequent agitation during spraying. Laboratory and field experiments were therefore carried out in 1939 and 1940 in Moscow to improve the stability of these suspensions and the amount of Paris green that remains on the surface of the water. Barber's mixture of 22 gm. Paris green and 44 cc. kerosene was compared with one of 22 gm. Paris green and 100 cc. kerosene with the addition of 250 cc. water and another of 22–40 gm. Paris green, 100–200 cc. kerosene, 24–40 gm. soft soap and 250 cc. water. All these were diluted with 10 litres water for use. When tested in the laboratory for ability to keep the Paris green in suspension and in the field for larval mortality, Barber's spray was inferior to the other two and the spray with soap was the best, though the percentage mortalities did not differ greatly. In other laboratory tests, Barber's spray was inferior to the soap spray as regards larval mortality and to the spray without soap for keeping the Paris green on the surface of the water after application. A suspension of 22 gm. Paris green, 44–100 cc. kerosene and 250 cc. water in 10 litres, which differed from the others in that it was prepared by wetting the Paris green with water before the kerosene was added to it, was superior to Barber's spray when judged by the last two criteria but gave lower percentages of mortality in the field.

[Shesterikova (A. A.) & Bushurova (A. A.).] **Шестерикова (А. А.) и Бушурова (А. А.). The Action of Bituminous By-products and some vegetable Poisons on Mosquito Larvae.** [*In Russian.*]—*Med. Parasitol.* **11** no. 1–2 pp. 23–24. Moscow, 1942. [Recd. 1943.]

An account is given of tests carried out in Barnaul, south-western Siberia, to find mosquito larvicides that could be obtained from local industrial by-products or plants. The substances were powders made of pyrethrum flowers, leaves of *Thermopsis lanceolata* or *Hyoscyamus niger* and leaves or roots of *Cicuta virosa*, and a product of the dry distillation of pine wood. This product is called tar water and is an oily dark-brown liquid with a specific gravity of 1·04–1·05. The sample used contained 20·5 per cent. turpentine, 33·96 per cent. phenol, 4·5 per cent. methyl alcohol, 1·95 per cent. acetic acid and its homologues, and 30·83 per cent. neutral tar oils.

Following laboratory experiments, the powders were broadcast at the rate of 0·4 oz. per sq. yd. over shallow pools infested with Anopheline larvae. The dusts of pyrethrum flowers or roots of *C. virosa* killed all the larvae in 3–5 hours; those of leaves of *C. virosa* and *T. lanceolata* did not kill all, even in 24 hours, and *Hyoscyamus* dust was ineffective. Tar water, applied at the rate of 9 oz. per sq. yd., killed all the larvae and prevented reinfestation for up to a month. It also killed all other forms of life in the pools at this rate, so that it must be used with care, and it did not possess sufficient spreading power for the rate to be reduced.

[Grechka (D. I.) & Bel'skaya (M. K.).] **Гречка (Д. И.) и Бельская (М. К.). Arsenical Sludge in the Control of Anopheline Larvae.** [*In Russian.*]—*Med. Parasitol.* **11** no. 1–2 pp. 25–27. Moscow, 1942. [Recd. 1943.]

Laboratory and field experiments against Anopheline larvae were carried out in May 1938 in the Province of Kharkov with an arsenical sludge obtainable in quantities from chemical works. It contains 10·6 per cent. arsenic trioxide,

7·8 per cent. arsenic pentoxide and 35 per cent. moisture, and was dried and ground to a fine powder for use. In the laboratory experiments, the powder was diluted with kaolin or road dust (1 : 1, 1 : 2, 1 : 10 and 1 : 20) and applied at rates equivalent to 0·9 and 1·8 lb. per acre. The lower rate of application and the two greatest dilutions of the dust were unsatisfactory, but the others gave good results, with complete mortality in 24 hours at 20–25°C. [68–77°F.]. In field tests, the powder was applied at the rate of 1·8 lb. per acre by means of a sieve, alone or diluted, at a water temperature of 21–30°C. [69·8–86°F.], and the results were estimated 12–48 hours later. The percentage mortalities were 99·2 for the undiluted powder, and 90–98 and 83 when it was diluted 1 : 2 or 1 : 3 and 1 : 5, respectively. Dilutions of 1 : 10 and 1 : 20 were again unsatisfactory. Most of the larvae died within the first 12 hours, and eggs hatched in the treated water after a day.

In further experiments, expanses of water in a flooded meadow, some of which had dense floating vegetation along the edges, were dusted from an aeroplane. The powder was applied alone at the rate of 0·9 lb. per acre and gave 89·2–96·7 per cent. mortality, but much of it was blown away before settling. It was therefore impregnated with crude oil at concentrations of 2, 2·5 and 5 per cent. The highest concentration caused the dust to form lumps aud clog the apparatus, but the lowest was satisfactory and gave 84 and 94 per cent. mortality when the dust was applied at the rate of 1·3 lb. per acre. When impregnated with 2½ per cent. oil and applied at the same rate it gave almost complete mortality. The oiled dust was easily discharged from the apparatus and formed an even film on the water. A mixture of 4 parts powder with 1 part road dust, impregnated with 3 per cent. oil and applied at 0·9 lb. per acre gave 95 per cent. mortality. In the controls, which were dusted with calcium arsenite, the percentage mortality was 94–94·6.

The dust had no detrimental effect on domestic animals that were fed on treated vegetation or on those that later grazed in the meadow.

[Shimanskiĭ (L. G.).] **Шиманский (Л. Г.). A Pneumatic Sprayer of medium Power.** [*In Russian.*]—*Med. Parasitol.* **11** no. 1–2 pp. 27–29, 2 figs. Moscow, 1942. [Recd. 1943.]

The spray apparatus described can be mounted in a boat or a cart and is suitable for treating large expanses of water infested with Anopheline larvae. The spray is discharged from a cylinder by compressed air as a triple jet 80 ft. or more long and having a working width of 30–65 ft., depending on the density and distribution of the vegetation.

[Polikarpova (L. I.).] **Поликарпова (Л. И.). The Influence of Shade on Anopheline Larvae in the Stalingrad Region.** [*In Russian.*]—*Med. Parasitol.* **11** no. 1–2 pp. 29–34, 3 figs. Moscow, 1942. [Recd. 1943.]

The investigations described were carried out from 10th July to 2nd September 1939 in water-courses and islands on the east bank of the Volga, near Stalingrad, where *Anopheles maculipennis*, Mg., is represented by var. *messeae*, Flni. Samples were taken every 10 days from various shaded waters and from an unshaded canal, all of which are described. The temperature ranged from 14 to 26·2°C. [57·2–79·16°F.] in the shaded waters and from 21·3 to 30·2°C. [70·34–86·36°F.] in the canal, and the season was favourable for the development of *Anopheles*, since there was no drought and the maximum air temperature did not exceed 35·8°C. [87·44°F.]. Larvae were taken in each type of water, and the results are shown in tables. The average numbers taken per sq. metre were 10·3 in water of which the banks were free from woody vegetation, but which was shaded by upright aquatic plants rising to a height of not more than 40 ins. and having a density of up to 85 stems per sq. metre,

6·2 and 8·3 in waters that had fairly dense aquatic vegetation rising above the surface and trees and shrubs on the banks, which shaded a strip of water up to 40 ins. wide, 3·8 in water that was covered with a dense growth of reeds rising to 10 ft. in height besides being shaded by large trees, and 5 in the unshaded canal.

It is concluded from these observations that in the Stalingrad area, which is characterised by drought in summer and constant winds, the shading of water by vegetation is favourable to the larvae.

[Utenkov (I. N.) & Lazuk (A. D.).] **Утенков (И. Н.) и Лазук (А. Д.). The Effect of antimalarial Reclamation in great River Flood-plains of the middle Zone of RSFSR.** [*In Russian.*]—*Med. Parasitol.* **11** no. 1–2 pp. 34–38. Moscow, 1942. [Recd. 1943.]

From a comparison of figures based on work in the Province of Smolensk in 1936–38, the authors estimate that the cost of controlling malaria by the reclamation of swamps that provide breeding places for Anophelines is equal to that of oiling the infested waters for 4 years or dusting them for 17. The choice of method will depend somewhat on local conditions and on such factors as a desire to promote general sanitation near towns and agriculture by land reclamation.

[Mikhaĭlov (A. I.).] **Михайлов (А. И.). The Influence of hydrotechnical Work on the Decrease of Malaria at Mariupol in 1935–1939.** [*In Russian.*]—*Med. Parasitol.* **11** no. 1–2 pp. 38–40. Moscow, 1942. [Recd. 1943.]

As a result of the almost complete reclamation in 1934–38 of two large swamps covering an area of about 200 acres near Mariupol, on the Sea of Azov, the number of cases of malaria in the town and adjoining villages decreased from 2,626 and 12,532 in 1935 to 390 and 1,230 in 1939. Counts of Anophelines in day-time shelters in a village near one of the swamps while the reclamation work was in progress and after its completion showed considerable reductions. Mariupol may now be considered free from malaria.

[Sabaneev (S. N.) & Smirnov (A. V.).] **Сабанеев (С. Н.) и Смирнов (А. В.). Some Conclusions from Experience of antimalarial Engineering Work in the Flood-plain of the Samarka River at Totskoie, Chkalov Province.** [*In Russian.*]—*Med. Parasitol.* **11** no. 1–2 pp. 41–45. Moscow, 1942. [Recd. 1943.]

An account is given of the methods adopted for reclamation work in a flooded area on the river Samarka in 1938–39, with particular reference to the types of machines used. Lakes and other Anopheline breeding places were abundant, but the lakes were made so shallow that they dried out every year towards the beginning of June, when the larvae were in the second or third instar.

[Chizhov (V. N.) & Bruich (V. N.).] **Чижов (В. Н.) и Бруич (В. Н.). On the Epidemiology of Malaria at Rostov on Don (1924–1940).** [*In Russian.*]—*Med. Parasitol.* **11** no. 1–2 pp. 45–52, 3 graphs. Moscow, 1942. [Recd. 1943.]

Malaria used to be intense in Rostov owing to the proximity of Anopheline breeding places, but its incidence has decreased since 1936, when measures against mosquitos were instituted. There are two more or less distinct waves of cases in the year ; the first, which begins in February and reaches a peak in May, consists of relapses and new cases due to infections contracted in the summer and autumn of the preceding year, while the second, which has a peak

in August–September, also includes cases due to infection acquired in the current year. Details are given of the breeding places in and near the town, and of their relation to malaria. Its higher incidence in parts of the town near them and the fact that several cases often occur in the same family indicate that much of the infection is acquired in houses.

[Leĭkina (L. I.).] **Лейкина (Л. И.). The Rôle of various Substrata in the Breeding of *Musca domestica*.** [*In Russian.*]—*Med. Parasitol.* **11** no. 1–2 pp. 82–86, 5 refs. Moscow, 1942. [Recd. 1943.]

The experiments described were carried out in the laboratory in the course of investigations on the breeding places of *Musca domestica*, L., in Kabarda in 1939 and in the Province of Archangel in 1940 [*cf. R.A.E.*, B **31** 124, 223]. The larvae were transferred soon after hatching to various media and the pupae that resulted were weighed and counted. The percentages that pupated and the average weights of the pupae in mg. were 81·75 and 22·8 for pig dung, 77·3 and 23·96 for human faeces, 65·4 and 21·34 for sheep dung, 56·1 and 18·84 for calf dung, 51·5 and 21·02 for cow dung and 47 and 15·05 for horse dung. These figures were multiplied together, and their product, termed the biomass, was taken as an index of the favourableness or otherwise of each medium. Though by this criterion human faeces are very favourable, they are frequently uninfested, probably because in latrines they are too liquid for the larvae to develop in them, or, if they are compact, the larvae are preyed upon by those of *Ophyra leucostoma*, Wied., *O. anthrax*, Mg., or *Hydrotaea dentipes*, F. [*cf.* **31** 124]. The other media become infested in the field according to the degree of their attractiveness to the ovipositing females of *M. domestica*, and this may explain the fact that, in the absence of pig dung, which is preferred, horse dung is constantly infested in the field, though it is a less favourable breeding medium than some others. It is concluded, therefore, that all kinds of dung, as well as kitchen refuse, should be made inaccessible to the flies.

[Petrova (E. F.).] **Петрова (Е. Ф.). Synanthropic Flies of Alma-Ata.** [*In Russian.*]—*Med. Parasitol.* **11** no. 1–2 pp. 86–89, 1 graph. Moscow, 1942. [Recd. 1943.]

Catches made in dwellings, animal quarters, a slaughter house and other buildings in Alma-Ata, south-eastern Kazakstan, in June–November 1940 showed that 19 species of flies were present. *Musca domestica*, L., was the commonest and occurred in all the buildings, though it was less numerous in the slaughter house than *Phormia* (*Protophormia*) *azurea*, Fall. Details are given of the local breeding places and of the seasonal prevalence of *M. domestica*.

[Gorkina (A. N.).] **Горкина (А. Н.). Dusts of "K," "SK" and Diphenylamine as Insecticides.** [*In Russian.*]—*Med. Parasitol.* **11** no. 1–2 pp. 90–91. Moscow, 1942. [Recd. 1943.]

Tables are given showing the percentage mortalities of lice [*Pediculus humanus*, L.] obtained when dusts containing different concentrations of diphenylamine or of the preparations termed K[dixanthogen] and SK-47 (containing 47 per cent. chlorine) [*cf. R.A.E.*, B **31** 226–228] were applied to small pieces of cotton, cloth and fur and the lice were confined with them for 24 hours. All the lice were killed in some of the tests with each material, but the concentrations shown as most effective in the tables are not always those considered most effective in the author's conclusions.

[Soboleva (N. I.).] **Соболева (Н. И.). The Influence of Antipediculin "SK" on the vital Functions of Lice.** [*In Russian.*]—*Med. Parasitol.* **11** no. 1–2 pp. 91–93. Moscow, 1942. [Recd. 1943.]

In laboratory experiments in Moscow in which lice [*Pediculus humanus*, L.] were placed for 30, 60, 90 or 120 minutes on fabric impregnated with 2 per cent. Antipediculin SK [*cf. R.A.E.*, B **31** 226] and then kept under suitable conditions, the last was the only exposure that prevented feeding on man 4 hours after treatment and oviposition within 24 hours of it and that gave complete mortality of the lice within 24 hours. Exposure to 1 per cent. of the preparation for 2 hours also prevented oviposition; it was not tested for mortality after this exposure, but was less effective at the others than 2 per cent.

[Balkashina (E. I.) & Meklenburtzeva (E. N.).] **Балкашина (Е. И.) и Мекленбурцева (Е. Н.). *Anopheles superpictus* as Malaria Vector in the Chimkent Region.** [*In Russian.*]—*Med. Parasitol.* **11** no. 1–2 pp. 94–95. Moscow, 1942. [Recd. 1943.]

Thirty cases of malaria due to *Plasmodium vivax* occurred in August and September 1937 in a small settlement about 10 miles south of Chimkent, southern Kazakstan, where two men were employed who had contracted the disease in Siberia in 1936. Numerous larvae of *Anopheles claviger*, Mg. (*bifurcatus*, auct.) were observed in two local springs in August, but the systematic oiling of these had no effect on the incidence of the disease. In August 1938, however, larvae of *A. superpictus*, Grassi, were found among aquatic vegetation in the bends of the local river, which was reduced by drought to a stream little more than a yard wide, and many females of this Anopheline in various stages of blood digestion were taken in inhabited houses, where they were the only mosquitos present. The destruction of these adults and the oiling of the stream every ten days resulted in a reduction of the number of cases to 16, and only two fresh cases occurred in 1939.

[Smetanina (M.) & Lazuk (A.).] **Сметанина (М.) и Лазук (А.). An Experiment on the Flight Range of *Anopheles* in the Volga Flood-plain.** [*In Russian.*]—*Med. Parasitol.* **11** no. 1–2 pp. 95–96, 1 fig. Moscow, 1942. [Recd. 1943.]

Over 3,000 stained adult Anophelines were released on 20th and 21st July 1939 on the flooded bank of the Volga some 2 miles from a town on the same side, and 3 miles from a village on the opposite bank. Catches were made in day-time shelters in these places during the next 10 days, and 0·25 and 1 per cent. of the total were recovered, respectively. The Volga is about a mile wide at this point.

[Belyaeva (G. A.).] **Беляева (Г. А.). Peristalsis of the Crop in Females of *Anopheles maculipennis messeae* Fall. at various Temperatures.** [*In Russian.*]—*Med. Parasitol.* **11** no. 1–2 p. 96. Moscow, 1942. [Recd. 1943.]

Observation of overwintering females of *Anopheles maculipennis*, Mg., var. *messeae*, Flni., from which the wings and legs were removed showed that peristalsis of the crop proceeded almost invariably from the anterior to the posterior end, and that each 10–14 pulsations were usually followed by a pause. At 0°C. [32°F.], the pauses lasted 1½–2½ minutes, but as the temperature rose they became shorter and were eliminated at 35°C. [95°F.]. The average number of pulsations per minute increased from 4 at 0°C. to 61 at 35°C. At 40°C. [104°F.], the mosquitos lived for only 3–5 minutes; the crop did not pulsate, but there were from 4 to 9 twitches per minute.

[Denisov (L. A.).] **Денисов (Л. А.). Sweet-flag in Mosquito Control.** [*In Russian.*]—*Med. Parasitol.* **11** no. 1–2 p. 97. Moscow, 1942. [Recd. 1943.]

The value of a powder made of the dried rhizomes of sweet-rush [*Acorus calamus*] as an insecticide and repellent [*R.A.E.*, B **31** 127] was not confirmed by tests against mosquitos carried out in December 1940 in the Province of Kalinin. Mosquitos in their hibernation quarters, where the temperature was 1–1·5°C. [33·8–34·7°F.], were dusted with a fine powder made of the dried rhizomes and applied at rates of 0·15–0·6 oz. per sq. yd., but the percentage mortalities were very low, and when mosquitos taken in hibernation quarters were confined at 18°C. [64·4°F.] in an insectary with dusted strips of paper, 39–93 per cent. alighted on the paper in an hour. The author has repeatedly observed larvae of *Anopheles maculipennis*, Mg., in sparse growths of sweet-rush.

[Fortushnuiĭ (V. A.).] **Фортушный (В. А.). The Obtaining of Eggs and Larvae of *Psoroptes* (*Dermatocoptes*) *cuniculi* and *P. equi* in the Laboratory.** [*In Russian.*]—*Med. Parasitol.* **11** no. 1–2 pp. 99–100. Moscow, 1942. [Recd. 1943.]

In the course of tests of ovicides against *Psoroptes cuniculi*, Delafond, and *P. equi*, Hering, a method was devised for obtaining large numbers of eggs and larvae. Scabious crusts removed from the skins of infested rabbits or horses were placed on black paper, and the mites that abandoned them were transferred for oviposition into small bags of soft fabric at the rate of 25–30 per bag; these were then tied and kept on damp filter paper in dishes. To avoid mould, the filter paper was changed daily and the dishes were not covered. On completion of oviposition, the mites were removed and the eggs left in the bags. The most favourable conditions were a temperature of 37–38°C. [98·6–104·4°F.] and a relative humidity of 85–90 per cent.

Emmel (M. W.). **Field Experiments in the Use of Sulfur to control Lice, Fleas and Mites of Chickens.**—*Bull. Fla agric. Exp. Sta.* no. 374, 8 pp., 1 fig., 2 refs. Gainesville, Fla., 1942. [Recd. 1943.]

The possibility that the control of lice on fowls in Florida by the addition of sulphur to their mash [*R.A.E.*, B **25** 285] was largely due to contamination of the feathers was confirmed by experiments in which there was no reduction in infestation on birds to which about the same amount of sulphur (5 gm.) was administered daily for three weeks in capsules, whereas heavily infested birds dusted with sulphur from a sprinkler-top can were free from lice a week later. Various field experiments were then made with dusting sulphur (of such fineness that 93–95 per cent. would pass through a 325-mesh sieve) conditioned with harmless clay, as it was thought that the finer sulphur would more easily contaminate the feathers. Feathers of fowls were freed from lice and from the sticktight flea [*Echidnophaga gallinacea*, Westw.] by the addition of 5 per cent. of this sulphur to the mash daily for three weeks after it had been applied to the yards and litter at the rate of 2 lb. per 100 sq. ft., but neither lice nor fleas were completely controlled when the mash was treated and the yards were not. The chicken mite [*Dermanyssus gallinae*, Deg.] was controlled, without treatment of the mash, by dusting the floors of houses, litter, dropping boards and nesting material; the birds themselves worked the sulphur into cracks and crevices. A combination of the treatments should therefore control all three pests. Birds with access to very sunny yards during treatment did not show more marked reductions in louse infestations than those in very shady ones [*cf. loc. cit.*], because they did not spend much time in the yards when the

sunshine was brightest. The sulphur did not have any apparent ill effect on the birds or impair the flavour of the eggs. The body temperature of the fowls was apparently sufficient to produce effective fuming and oxidation of the sulphur even in cool weather.

ROBINSON (C. S.). **Some Observations on the Pajaroello Tick** (*Ornithodorus coriaceus*).—*J. For.* **40** no. 8 pp. 659–660. Washington, D.C., 1942. [Recd. 1943.]

In Los Padres National Forest, California, *Ornithodoros coriaceus*, Koch, occurs at altitudes of 500–6,500 ft. and it appears to be spreading. It is usually found under trees in places where stock and deer gather and is most active from May to September. About six months of the winter and spring are passed in hibernation, some 6–10 inches below the surface of the ground or in old stumps. The bite of this tick in man is usually accompanied by swelling and irritation. In some cases, hospital treatment has been necessary, and inflammation has lasted for months. Horses are sometimes attacked, but cattle are either not bitten or do not exhibit signs of distress.

Amblyomma americanum **a Vector of Rocky Mountain Spotted Fever.**—*Publ. Hlth Rep.* **58** no. 12 p. 491. Washington, D.C., 1943.

The rickettsia of Rocky Mountain spotted fever has been recovered by R. R. Parker, G. M. Kohls and E. A. Steinhaus from nymphs of *Amblyomma americanum*, L., collected in September 1942 in Oklahoma from vegetation near the home of a person recovering from the disease [*cf. R.A.E.*, B **31** 42].

MILLS (H. B.). **Two Human Diseases which may be contracted from Montana Rodents.**—*Misc. Publ. Mont. Bd Ent.* no. 1, [8] pp., 4 refs. Helena, Mont., 1941. [Recd. 1943.]

Many species of rodents occur in Montana, and they act as reservoirs of plague and tularaemia. The history and distribution of plague are discussed, and the various forms are described. Its occurrence in rodents in Montana was established in 1935 [*R.A.E.*, B **24** 252] when ground squirrels [*Citellus*] were infected in large numbers. It must have entered the State from the south and is spreading to the north, east and west. About 20 species of fleas attack native rodents in Montana, but only three of them, *Pulex irritans*, L., *Ctenocephalides canis*, Curt., and *C. felis*, Bch., commonly attack man, and they are thought to be poor vectors of plague. *Xenopsylla cheopis*, Roths., the most efficient vector, has not been collected in the State. Batches of other fleas from apparently healthy rodents have been found to be infective when injected into other rodents and have produced infective faeces. It would appear, therefore, that plague is endemic in the native rodents and is spreading gradually in the absence of a good vector. The importance of birds in its spread is discussed [*cf.* **27** 204], and the probable means of dissemination among rodents and the ways in which man contracts the disease are shown. It is recommended that dead or diseased rodents should not be handled, infestations of the brown rat [*Mus norvegicus*] should be destroyed and also all ground squirrels in the neighbourhood of towns in the infected area.

Tularaemia is also prevalent in rodents in the State. A list is given of some of the animals susceptible to it, and its symptoms, the ways in which it is transmitted to man, including the bites of insects and ticks, and precautions to be taken against it are briefly reviewed.

JENKINS (R. B.). **Tularaemia in Canada.**—*Proc. 6th Pacif. Sci. Congr. 1939* **5** pp. 75–77, 2 refs. Berkeley, Calif., 1942. [Recd. 1943.]

There is some evidence of an outbreak of tularaemia in man in Nova Scotia in 1912, but the first proved Canadian case occurred in Ontario in 1930. There have since been two cases in Nova Scotia, two in Quebec, 14 in Ontario, 16 in Alberta and 4 in British Columbia. Bites of deer-flies [*Chrysops* spp.] were responsible for three of them, and the possibility of transmission by tick-bite was considered in one that occurred in southern Alberta in an area where *Dermacentor andersoni*, Stiles, is prevalent. Ticks carrying virulent strains of *Bacterium tularense* have been collected in several areas of British Columbia and Alberta [*cf. R.A.E.*, B **31** 201].

SUÁREZ (P. A.). **Plague in the Province of Chimborazo, Ecuador.**—*Proc. 6th Pacif. Sci. Congr. 1939* **5** pp. 115–123. Berkeley, Calif., 1942. [Recd. 1943.]

A sudden outbreak of septicaemic plague with clinical pneumonic localisation, consisting of 16 fatal cases, occurred at Riobamba in the province of Chimborazo, Ecuador, between 8th and 14th February 1939. This was most unexpected, as *Xenopsylla cheopis*, Roths., is absent from the town. An account is given of the investigations made, in the course of which the existence of virulent bacilli in the throat of a healthy carrier was demonstrated. In view of this, the author attributes the epidemic, and similar ones, to direct transmission from man to man without the intervention of a vector or rodent reservoir. Many towns and small villages in the province are permanent endemic areas, where epidemics sometimes break out without an increase in the number of rats, a rodent epizootic or the presence of *X. cheopis*. The fleas taken at Riobamba were *Pulex irritans*, L. (94) on man, *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt. (11) on domestic animals, *Rhopalopsyllus* (77) and *Hectopsylla suarezi*, Fox (6) on guineapigs and rabbits, and *Leptopsylla* (9) on rats [*cf. R.A.E.*, B **19** 17]. Data on fleas in the communities of Chimborazo from December 1926 to July 1927 and the cases of plague that occurred there and mortality caused by them between 1913 and 1939 are shown in tables. It is stated that in some cases *Hectopsylla* acts as a vector between guineapig and man.

MAIL (G. A.) & HOLLAND (G. P.). **Siphonaptera of western Canada in Relation to Sylvatic Plague.**—*Proc. 6th Pacif. Sci. Congr. 1939* **5** pp. 125–128, 4 refs. Berkeley, Calif., 1942. [Recd. 1943.]

Although plague has not been recorded from British Columbia or Alberta, the presence of the sylvatic form in the neighbouring part of the United States has led to survey work in these Provinces and the accumulation of many records of fleas there. Lists, with host and locality records, are given of the 33 species that are known or assumed to be common to British Columbia and Alberta, and of 38 others recorded from British Columbia and 12 recorded from Alberta. The 15 proved natural or laboratory vectors of sylvatic plague in North America, of which eight occur in the previous lists, are also recorded. They include *Ceratophyllus* (*Thrassis*) *acamantis*, Roths., the commonest flea of the British Columbia interior, where it occurs in very large numbers on marmots (*Marmota*), and *C.* (*Orchopeas*) *sexdentatus*, Baker, and *C.* (*Monopsyllus*) *eumolpus*, Roths., which are common on pack rats (*Neotoma*) and chipmunks (*Eutamias*), respectively. Should plague become established in western Canada, its spread among native hosts would therefore probably be rapid.

Martinez (L. J.). **Plague in the City of Ambato, Ecuador.**—*Proc. 6th Pacif. Sci. Congr. 1939* **5** pp. 139–143. Berkeley, Calif., 1942. [Recd. 1943.]

Plague broke out in Ambato in 1916, eight years after it first appeared in Ecuador. At this time, rats, which had been absent from the town until the railway was built, were abundant. There was another outbreak in 1926. The last human cases occurred in 1929, but rodent plague persists. The commonest and second commonest fleas on various hosts were found to be *Pulex irritans*, L., and *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt., on man and rabbits, *Xenopsylla cheopis*, Roths., and *Ceratophyllus* on rats, *Ceratophyllus* and *Leptopsylla* on mice, and *Rhopalopsyllus* and *Hectopsylla suarezi*, Fox, on guineapigs. The results of annual examinations of rats for plague infection and fleas between 1929 and 1938 are given.

Rosenbusch (F.). **Equine Encephalomyelitis in the Argentine in its experimental Aspects.**—*Proc. 6th Pacif. Sci. Congr. 1939* **5** pp. 209–214, 20 refs. Berkeley, Calif., 1942. [Recd. 1943.]

A serious epizootic of encephalomyelitis occurred in horses over the whole agricultural zone of Argentina in the summer of 1919, another of less intensity in the centre and north of the country in 1933 and a third one in the eastern provinces in 1935–36. There were a few isolated cases in 1938–39. Outbreaks coincided with rainy years and occurred in the regions infested with *Culex*. Regions heavily infested with *Aëdes* were not especially affected. In recent years, the disease has been observed in Brazil, Uruguay, Chile, Peru, Colombia, Venezuela, Panama and the Guianas. Its epidemiology is discussed, and experiments on the sensitivity of various animals to the virus and on immunisation of horses are described.

Gibbons (R. J.). **Rocky Mountain Spotted Fever in Canada.**—*Proc. 6th Pacif. Sci. Congr. 1939* **5** pp. 573–575, 1 ref. Berkeley, Calif., 1942. [Recd. 1943.]

Of the 12 authenticated cases of Rocky Mountain spotted fever that have been recorded in Canada, three occurred in British Columbia in 1917 and 1936, eight in Alberta in 1923, 1935, 1936 and 1938, and one in Saskatchewan in 1929. There have been several other cases with clinical histories suggestive of this disease. *Dermacentor andersoni*, Stiles, is abundant in the dry belt of British Columbia east of the Coast Range and throughout southern Alberta and south-western Saskatchewan and has been recorded from Manitoba. It is slowly spreading westwards in British Columbia. It becomes active in late March and remains so for 1–3 months according to district [*cf. R.A.E.*, B **28** 143]. No cases of Rocky Mountain spotted fever have been recorded from eastern Canada, although *D. variabilis*, Say, which transmits it in the eastern United States, is found in Manitoba, parts of Saskatchewan, and a few districts in Ontario and has been reported as far east as Labrador. *Haemaphysalis leporis-palustris*, Pack., believed to be of importance in the maintenance of *Dermacentroxenus rickettsi* in animals, is the most widely distributed tick in Canada, and individuals collected in northern Manitoba induced reactions indicative of low-grade Rocky Mountain spotted fever in guineapigs. During the spring and early summer of 1938 and 1939, 29,500 and 22,600 ticks, respectively, nearly all *Dermacentor andersoni*, were collected in southern British Columbia and southern Alberta [*cf. loc. cit.*]. No infections with Rocky Mountain spotted fever were found in those collected in 1938, but typical strains of virulent *Dermacentroxenus rickettsi* were demonstrated from five out of about 300 lots,

comprising 9,000 ticks, in 1939. All the positive ticks came from an area in south-eastern Alberta where fatal human cases had occurred in 1935 and 1936, though the negative ticks of the previous year had included many from this district. Tularaemia bacteria were isolated from several of the ticks in both years.

Spink (W. W.). **Rocky Mountain Spotted Fever in Minnesota.**—*Proc. 6th Pacif. Sci. Congr. 1939* **5** pp. 585–588, 8 refs. Berkeley, Calif., 1942. [Recd. 1943.]

Rickettsial diseases are considered rare in Minnesota. A case identified as typhus was recorded in 1915, and two proved cases of indigenous Rocky Mountain spotted fever and a probable one have been diagnosed since 1931. There is thought to be no record of *Dermacentor andersoni*, Stiles, in Minnesota or the eastern parts of North Dakota, South Dakota and Nebraska, but *D. variabilis*, Say, and *Haemaphysalis leporis-palustris*, Pack., are common, and *D. albipictus*, Pack., is often found in northern Minnesota. It infests moose and other deer in large numbers during autumn and winter and remains for a long time on its host. It is possible that *D. variabilis* is responsible for the transmission of Rocky Mountain spotted fever to man. There are indications that the Minnesota strain is of low virulence, and the number of cases of recognised infection in man may be so small because the disease produced is usually mild and atypical.

Anigstein (L.). **The Problem of the Etiology of Tropical Typhus in Malaya.**—*Proc. 6th Pacif. Sci. Congr. 1939* **5** pp. 619–622. Berkeley, Calif., 1942. [Recd. 1943.]

The greater part of this report deals with the author's own investigations on the causal agent of the rural form of Malayan tropical typhus, which was later shown to be identical with tsutsugamushi disease [*cf. R.A.E.*, B **26** 20]. He discusses the relation between typhus rickettsiae and *Proteus* X and inclines to the view that they are the parasitic and saprophytic stages of the same organism, but is undecided as to whether the transformation to the saprophytic phase takes place as the result of a possible life-cycle of the rickettsia or whether the proteus appears as an abrupt mutation. Although the human louse [*Pediculus humanus*, L.] plays no part in transmission of the Malayan disease [*cf.* **19** 97, etc.], investigations were carried out to determine whether it could be artificially infected and so be used as a biological medium and the appearance of the organism in it compared with that of cultures on artificial media. Some 2,000 lice were, therefore, imported and infected by feeding or by anal injection. Minute dumb-bell shaped diplococci and delicate rods, as well as coccobacilli showing bipolar staining, could be found in masses in gut smears after eight days of feeding, and still more conclusive results were obtained by inoculation of patients' blood, which resulted in the appearance of enormous numbers of organisms resembling the rickettsiae of tsutsugamushi disease [**19** 160] in morphology and staining properties. Organisms of the same type were demonstrated in the tunica vaginalis of guineapigs and rats inoculated with the gut emulsion of artificially infected lice. There was no evidence that multiplication took place intracellularly. Cultures of strains from man, rodents and lice on Hottinger broth and chocolate blood agar were highly pleomorphic and had pathogenic properties correlated with their morphological type. These phenomena, together with their serological properties suggested that they were biological phases of the tsutsugamushi rickettsia, one of them being the saprophytic proteus type.

Morishita (K.). **Tsutsugamushi Disease : its Epidemiology in Formosa.**—*Proc. 6th Pacif. Sci. Congr. 1939* **5** pp. 639–647, 11 refs. Berkeley, Calif., 1942. [Recd. 1943.]

The epidemiology of tsutsugamushi disease on the main island of Formosa and in the Pescadores Islands is discussed separately on the basis of new data from various sources, including the author's own observations. The disease is widely distributed on the main island, in the mountainous regions (6,500 ft. above sea level) as well as in the plains, but the endemic areas are more or less localised. It occurs throughout the year, but chiefly between June and October, and is contracted mainly by adult males in the course of work in the fields. Between 1933 and 1938, the incidence showed a tendency to decrease. The percentage mortality for this period was 12 [*cf. R.A.E.*, B **10** 41]. The only known vector is *Trombicula akamushi*, Brumpt, which feeds on man and other mammals, chiefly rats and mice, and also birds, during the larval stage. The eggs are laid in the ground. The causal organism of the disease is passed from the larvae of one generation to those of the next. It is thought that not all the hosts of the mite can act as reservoirs of the disease. The most important are probably *Mus* (*Rattus*) *losea* and *Apodemus agrarius*. The correct specific name for the *Rickettsia* that causes tsutsugamushi disease is discussed. The Formosan rickettsiae are morphologically identical with those of northern Japan but show some biological differences, particularly as regards their behaviour in rabbits, in which scrotal swelling has never been observed by the author. It is difficult to detect the rickettsiae from Formosan cases unless mice are used. The author is of the opinion that the Formosan type may be a variety or at least a local variation of tsutsugamushi disease.

The disease was discovered in the Pescadores Islands in 1931, but was certainly present earlier. It is contracted from April to November in areas surrounding human dwellings, and is most prevalent in children. The percentage mortality for all observed cases was only 5·6. It is not known to be contracted in fields remote from habitations as it is in the main island, probably on account of the peculiar meteorological conditions. A very strong monsoon carrying salt spray blows during the winter and causes plants to wither unless they are artificially protected. For this reason, the inhabitants protect some area near their homes with coral walls. *Mus* (*R.*) *rattus rufescens*, *M.* (*R.*) *norvegicus* and *M. musculus taiwanus* live in or near the dwellings and these walls, and *Trombicula akamushi* develops in the ground inside the walls. *M. r. rufescens* has been found heavily infested by the mite and rickettsiae have been demonstrated in its tissues.

Macchiavello (A.). **Investigations of Chilean Exanthematicus Typhus and experimental Exanthematous Typhus.**—*Proc. 6th Pacif. Sci. Congr. 1939* **5** pp. 649–675, 58 refs. Berkeley, Calif., 1942. [Recd. 1943.]

Typhus is endemic in Chile, and epidemics have occurred from time to time, including a serious one that broke out in 1932 and spread to all provinces. All developed in spring and summer except one in Valparaiso in 1937. The epidemiology is discussed, and an account is given of various experiments connected with it, including many on the infectivity to guineapigs of lice [*Pediculus humanus*, L.] collected from typhus patients and contacts. Inoculation of lice from serious, moderate and mild cases gave positive results in 56·1, 30·7 and 17·8 per cent. of the tests, respectively. Positive results were obtained with lice taken from light cases from the sixth to the tenth days of illness, from cases of medium severity from the fifth day onwards and from severe cases throughout illness, but in greatest proportion from the ninth to the eleventh days. As death usually occurs in severe cases in 12-14 days, lice leave the body and seek new hosts when they are most infective. This accounts

for the numerous cases contracted at the funerals of typhus patients. The importance of the early isolation of severe cases is pointed out. Lice taken from a woman two months after convalescence were infective, though her blood could not be proved infectious and experiments on the infection of lice by feeding them on the blood of convalescents were negative, which suggests that infected lice may live longer than is generally supposed. Details are given of the finding of infected lice on 19th August and 10th September 1938 on a person who had been in contact with a severe case earlier in August, had no history of having had typhus previously, did not develop it and showed no evidence of immunity. Lice taken from him in February were not infective, and healthy lice fed on him did not become so. Guineapigs developed typhus as a result of the inoculation of either live or dead lice taken from the mattress of a typhus patient 25 days after his removal to hospital.

A brief account is given of the benign endemic typhus of Antofagasta [*R.A.E.*, B **21** 264]. The sick were usually free from ectoparasites. Rats were proved to be reservoirs, and the disease was transmitted from rat to rat by *Polyplax spinulosa*, Burm., and *Xenopsylla cheopis*, Roths. Experiments with *Cimex lectularius*, L., *L[eptopsylla] segnis*, Schönh. (*musculi*, Dugès), *Echidnophaga gallinacea*, Westw., *Pulex irritans*, L., *Liponyssus bacoti*, Hirst, and *Echinolaelaps* (*Laelaps*) *echidninus*, Berl., were negative. Examples of *Dermacentor*, *Ornithodoros*, *Rhipicephalus sanguineus*, Latr., and *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt., collected from dogs were not infected.

Baker (C. G.), Archer (G. T. L.) & Mitchell-Heggs (G. B.). **Endemic Typhus Fever in Diego Suarez, Madagascar.**—*Brit. med. J.* no. 4320 pp. 506–508. London, 1943.

Fevers of the typhus group were believed not to occur in Madagascar, but ten cases were recorded there among troops in 1942. Details of these are given. None of them was infested with lice, though all had been bitten by insects recently. Fleas were found on rats where some of them had slept or been on duty, and all the dogs in the neighbourhood were infested with ticks.

Boshell M. (J.) & Kerr (J. A.). **Veinticinco especies nuevas de Trombidiideos de Colombia.** [Twenty-five new Species of Trombidiids from Colombia.] —*Rev. Acad. colomb. Cienc.* **5** no. 17 pp. 110–127, 2 pls., 51 figs. Bogotá, 1942. [Recd. 1943.]

Two of the new species described (both from larvae) are *Trombicula pastorae* from the domestic fowl and *T. landazuri* from rodents and man.

Mazza (S.) & Chacon (R. V.). **Presencia de *Panstrongylus geniculatus* con infestación por *S. cruzi* en el oriente boliviano y otras informaciones relacionadas con la enfermedad de Chagas en esa región.** [The Occurrence in eastern Bolivia of *P. geniculatus* infected by *Trypanosoma cruzi* and other Information on Chagas' Disease in this Region.]—*Prensa méd. argent.* **30** no. 25 repr. 15 pp., 4 figs., 7 refs. Buenos Aires, 1943.

Prior to 1942, the Triatomids known from Bolivia were *Triatoma infestans*, Klug, *T.* (*Eutriatoma*) *sordida*, Stål, and *T.* (*E.*) *venosa*, Stål, but in that year, the senior author recorded *T.* (*E.*) *oswaldoi*, Neiva & Pinto, and *Psammolestes coreodes*, Bergr., there [*R.A.E.*, B **31** 111]. In March 1943 a male of *Panstrongylus geniculatus*, Latr., infected by *Trypanosoma* (*Schizotrypanum*) *cruzi* was taken in a dwelling in the Department of El Beni. Infected examples of *Triatoma infestans* were taken in dwellings in various villages at altitudes of up to about 8,000 ft., and altitude did not appear to affect the proportion of

the bugs infected, though the virulence of the parasite was apparently greater at the higher localities. Attempts to obtain definite proof of the occurrence of Chagas' disease in man were unsuccessful.

Mazzotti (L.) & Osorio (M. T.). **Experimentos de transmisión de** *Trypanosoma cruzi* **en cuatro especies de** *Ornithodoros*. [Experiments in the Transmission of *T. cruzi* to four Species of *Ornithodoros*.]—*Rev. Inst. Salub. Enferm. trop.* **4** no. 2 pp. 163–165, 1 ref. Mexico, D.F., 1943. (With a Summary in English.)

Batches of three examples of *Ornithodoros furcosus*, Newm., collected in Ecuador, three of *O. parkeri*, Cooley, bred from ticks collected in California, and four of *O. amblus*, Chamb., collected in Peru were fed on mice infected with *Trypanosoma cruzi*, and a suspension of each batch was inoculated into two healthy mice, 429, 158 and 195 days later, respectively. Five of the six mice became infected, and the crushed ticks of each species contained flagellates similar to the developmental forms of *T. cruzi*. In similar experiments with batches of four and two examples of *O. hermsi*, Wheeler, bred from ticks collected in Colorado, no flagellates were found in the ticks and the inoculated mice did not become infected.

Kumm (H. W.), Bustamante (M. E.) & Herrera (J. R.). **Informe sobre algunos** *Anopheles* **hallados en la frontera de Mexico y Guatemala (1942).** [Some *Anopheles* found on the Frontier of Mexico and Guatemala.]—*Rev. Inst. Salub. Enferm. trop.* **4** no. 2 pp. 183–187, 1 map, 11 refs. Mexico, D.F., 1943.

The authors give records of the Anophelines taken during a journey in the Department of Petén, Guatemala, and the adjoining State of Chiapas, Mexico, in April 1942, supplemented by the results of observations by A. Martínez Palacios in the neighbouring State of Tabasco, Mexico. *Anopheles apicimacula*, D. & K., *A. punctimacula*, D. & K., *A. darlingi*, Root, *A. albimanus*, Wied., *A. pseudopunctipennis*, Theo., *A. vestitipennis*, D. & K., and *Chagasia bathanus*, Dyar, were found in both countries, *A. gabaldoni*, Vargas, in Mexico, and *A. strodei*, Root, in Guatemala. Adults of *A. darlingi* were taken in houses in villages near rivers, and it is considered that this species is partly responsible for the endemic malaria that occurs in the forest zones traversed.

Causey (O. R.), Deane (L. M.), Deane (M. P.) & Sampaio (M. M.). *Anopheles* (*Nyssorhynchus*) *sawyeri*, **a new Anopheline Mosquito from Ceará, Brazil.**—*Ann. ent. Soc. Amer.* **36** no. 1 pp. 11–15, 4 pls. Columbus, Ohio, 1943.

The authors consider it probable that several species of *Anopheles* are at present included under the name of *A. argyritarsis*, R.-D., and describe the immature stages, adult female and male genitalia of one such species, *A. sawyeri*, sp. n., from north-eastern Brazil. It can be separated from *A. argyritarsis* in all stages. It was taken in small numbers and on one malaria-free plateau only, feeding on a horse used as bait.

Bates (M.). **Mosquitoes as Vectors of** *Dermatobia* **in eastern Colombia.**—*Ann. ent. Soc. Amer.* **36** no. 1 pp. 21–24, 7 refs. Columbus, Ohio, 1943.

An account is given of the oviposition behaviour of *Dermatobia hominis*, Say, from observations made in Colombia, in many parts of which it is a major pest of cattle. When ready to oviposit, the female is attracted to a warm-blooded animal and waits on it until a mosquito or other zoophilous fly approaches, when it seizes it while it is still in flight and oviposits in it while hovering.

It is indifferent to stationary mosquitos. Many potential vectors were lost in the pre-oviposition struggle, apparently because they were too large, too small or too active. *Dermatobia* adults were found only in the forest and during midday hours, but they were more than once carried for half a mile or more over open country on man or horse. Small calyptrate flies probably carry *Dermatobia* eggs as frequently as mosquitos, but no opportunity arose to study them. Data are given on the incidence of the eggs on mosquitos of various species in different forests and under different conditions. The most usual vectors were *Psorophora ferox*, Humboldt, on which eggs were found in every month, and *Aëdes serratus*, Theo., but eggs occasionally occurred on *P. cingulata*, F., *Haemagogus capricorni*, Lutz, and species of *Wyeomyia* and *Mansonia*, and once on *Anopheles boliviensis*, Theo. The difference in abundance of *Dermatobia* in various forests appeared to bear no relation to the number of cattle in the neighbourhood.

HORSFALL (W. R.). **Some Responses of the Malaria Mosquito to Light.**—*Ann. ent. Soc. Amer.* **36** no. 1 pp. 41–45, 2 figs., 9 refs. Columbus, Ohio, 1943.

Collections of mosquitos made in the years 1939–41 in a modified New Jersey light-trap [*cf. R.A.E.*, B **31** 195] in the rice-growing region of Arkansas showed that, unlike members of the genus *Psorophora*, which emerge from the rice-fields over a short period beginning a few days after flooding and are caught in numbers proportionate to the acreage being flooded and its proximity to the trap, *Anopheles quadrimaculatus*, Say, emerges throughout the summer in fairly regular numbers from all flooded fields and enough of these can be found near a trap to provide a fairly constant catch. Nevertheless, there were cyclic variations in the numbers taken. In 1939 and 1941, the seasons when large numbers were collected, there were four and three peaks, respectively, and there would almost certainly have been a fourth peak in the latter year if collection had continued long enough. The peaks occurred with or shortly after the appearance of the new moon. Hardly any examples of this Anopheline were collected when the moon was full. Of the total numbers taken in a night, **75** per cent. were collected between 11 p.m. and 3 a.m. when the moon was new, between 12 and 3 a.m. when it set at midnight, between 9 p.m. and 2 a.m. when it was full, and between 9 p.m. and 1 a.m. when it began the last quarter.

ROSS (E. S.). **The Identity of *Aëdes bimaculatus* (Coquillett) and a new Subspecies of *Aëdes fulvus* (Wiedemann) from the United States (Diptera, Culicidae).**—*Proc. ent. Soc. Wash.* **45** no. 6 pp. 143–151, 4 figs., 3 refs. Washington, D.C., 1943.

The adults of both sexes and the fourth-instar larva of *Aëdes bimaculatus*, Coq., are described, and *A. rozeboomi*, Vargas [*R.A.E.*, B **30** 32] is shown to be a synonym of it. Its range extends from central Texas to Salvador. Larvae were taken in a roadside ditch in Texas in May 1942, and pupae and adults but no larvae in September 1942 in or around large clear roadside pools at the type locality in the extreme south of Texas. This is thought to indicate non-continuous breeding. The mosquito in the south-eastern United States that had been identified as *A. bimaculatus* or as *A. fulvus*, Wied., is described as *A. f. pallens*, subsp. n., from adults of both sexes; the characters of the fourth-instar larva are figured. The typical *A. fulvus*, which is widespread in the Neotropical region, is also described from adults of both sexes from Panama. Very brief notes on the biology of *A. f. pallens* are given from Barret's observations [**7** 106]. The females have been reported to be severe biters.

Summers (W. A.). **Experimental Studies on the larval Development of *Dirofilaria immitis* in certain Insects.**—*Amer. J. Hyg.* **37** no. 2 pp. 173-178, 7 refs. Lancaster, Pa., 1943.

A summary is given of studies on the ability of ten species of mosquitos and three species of fleas occurring in southern Louisiana to act as intermediate hosts of *Filaria* (*Dirofilaria*) *immitis*, which is prevalent in dogs there. Both laboratory-bred and wild mosquitos were used; they were fed on infected dogs in a number of ways and then isolated in bottles covered with cheese cloth, provided with soaked raisins and moisture and kept at room temperature. Fleas were collected from filaria-free dogs and kept on an infected one until they were examined. Mosquitos were considered infected when the filarial larvae had become established in the cells of the Malpighian tubules and fleas when they had penetrated the alimentary tract and entered the haemocoele. The insects were considered successful carriers only if the filarial larvae reached the infective stage. On the basis of the experimental results, the mosquitos are divided into four groups. The first includes *Culex apicalis*, Adams, and almost all examples of *C. fatigans*, Wied., which refused to feed, the second, in which the filarial larvae failed to develop because of some inhibitory factor [*cf. R.A.E.*, B **26** 210], comprises *C. salinarius*, Coq., *Aëdes aegypti*, L., *A. vexans*, Mg., *Psorophora posticata*, Wied., and the very few examples of *C. fatigans* that fed, the third consists only of *C. territans*, Wlk., in which larval development took place but with some retardation, and the fourth group comprises three species, *A. infirmatus*, D. & K., *A. sollicitans*, Wlk., and *Anopheles crucians*, Wied., in which complete larval development took place without evidence of retardation and with considerable damage to the insect. Mature larvae were observed in the proboscis of the last four species. It is concluded that only these species can be considered potential vectors and that they are not necessarily efficient ones, since other factors, including the length of survival of infected individuals in nature, the population density of the species and its relationship with dogs must be considered in order to estimate the part it plays in transmission. Probably none of the susceptible species studied has all the attributes of a successful vector.

Microfilariae and all other developmental stages were observed simultaneously in the haemocoele of naturally infected fleas [*cf.* **29** 186] as well as in experimentally infected ones. *Ctenocephalides canis*, Curt., appeared to be more susceptible to experimental infection than *C. felis*, Bch., or *Pulex irritans*, L., and was more frequently found infected in nature on infected dogs. The great susceptibility of fleas to infection, their immunity from tissue damage by the larvae and their frequent association with dogs suggest that they may be more responsible for maintaining infection than is generally believed. Larval development in *C. canis* was quicker in summer than in winter. The mode of escape of infective larvae from fleas is not known, but mature larvae in heavily infected fleas were seen on many occasions to be penetrating membranes connecting the chitinous plates composing the body wall of the flea, especially in the region between the thoracic and abdominal segments.

Doner (M. H.) & Thomssen (E. G.). **Bedbugs and their practical Control.**—*Soap* **19** no. 6 pp. 109–111, 127, 8 refs. New York, N.Y., 1943.

A key is given to the Cimicids of America north of Mexico, together with notes on the bionomics and control of *Cimex lectularius*, L. It is recommended that heavy infestations should be controlled by fumigation carried out by licensed operators and lighter household ones by the repeated application of fly sprays under pressure to the hiding places of the bugs.

PEARCE (A. H. B.). **Report of the Director of Medical Services (British Guiana) for the Year 1941.**—14 pp. Georgetown, Demerara, 1942. [Recd. 1943.]

This report includes an appendix on the work of the yellow fever service in British Guiana in 1941 (p. 9) and one on the work of the malaria research unit (pp. 10–14) by G. Bevier. No cases of yellow fever came to the notice of the authorities. The area controlled by the yellow fever service was extended and had a population of over 100,000 at the end of the year. The house indices for breeding of *Aëdes aegypti*, L. [*R.A.E.*, B **26** 42] ranged from 1 to 5 per cent., except at Bartica, a newly controlled district, and in the most congested part of Georgetown, where they were higher. The indices were reduced most rapidly in rural areas. Data from two districts showed that while the indices for breeding of *A. aegypti* had fallen fairly uniformly and remained low, those for all species of mosquitos fluctuated with rainfall, regularity of oiling of latrines and the conditions of canals and trenches. In other districts, including Georgetown, *Culex* and *Aëdes* indices fell together. A maritime service put into operation in October examined about 220 boats per week in the harbour, and found *Aëdes* breeding in 3·9 per cent. of them and mosquitos in 6·9 per cent. At Bartica, initial indices of 43 per cent. for all species and 40 per cent. for *Aëdes* were reduced by the end of the year to 9 and 7 per cent., respectively.

The summary of the work of the malaria unit includes records of the numbers of larvae and adults of various species of *Anopheles* taken, and notes on them with particular reference to *A. darlingi*, Root, the most important vector. This species was unevenly distributed, and adults were always easier to find than larvae. The larvae occurred in waters with a pH of 4·5–7·3 and a salt content of 0·028–0·126 gm. per litre measured with silver nitrate reagents. The number of favourable breeding places by these standards was shown to increase when larvae began to reappear in June after the end of a drought that had lasted 33 months. In this month, *A. darlingi* was found in one controlled area from which it had completely disappeared in 1940. Larvae of *A. albitarsis*, Arrib., occurred in waters with a pH of 4·9 -7·1 and a salt content of 0·064 gm. per litre or less, and those of *A. triannulatus*, Neiva & Pinto, in waters with a pH of 5·5–7·3. Malaria rates were low in 1940 and apparently in 1941.

KATES (K. C.). **Development of the Swine Thorn-headed Worm, *Macracanthorhynchus hirudinaceus*, in its Intermediate Host.**—*Amer. J. vet. Res.* **4** no. 11 pp. 173–181, 25 figs., 15 refs. Chicago, Ill., 1943.

Descriptions are given of the developmental stages of *Macracanthorhynchus hirudinaceus* in larvae, pupae and adults of *Cotinis nitida*, L., and various species of *Lachnosterna* (*Phyllophaga*), the most important intermediate hosts in the United States. The grubs were experimentally infected in the last instar. Acanthors (larvae in which the embryonic structures predominate), closely resembling those in the egg, were recovered from the midgut of grubs as early as one hour after the latter had been given access to soil containing eggs; motile acanthors of this stage occur either in the midgut tissues or the body cavity. Second-stage acanthors were found attached to the outer surface of the midgut or sometimes free in the body cavity 5–20 days after infection. The author recognises six acanthella stages, of which the last is the one infective to pigs, although development is continuous. All occur in the body cavity of the grubs, pupae or beetles, and were found, respectively, 15–25, 20–35, 30–45, 40–55, 50–65 and 60–90 days after experimental infection. A mean temperature of 75°F. was maintained in the laboratory throughout [*cf.* *R.A.E.*, B **28** 101]. When infected grubs were exposed to normal summer temperature in outdoor soil plots in Maryland, the minimum time required for development to the infective stage was about three months. Growth processes in both parasite and host practically cease when the soil temperature

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falls to 40°F. or less [*cf. loc. cit.*]. When grubs become infected in the summer or autumn, development and activity of both host and parasite continue as long as soil conditions and temperature remain favourable, cease during the winter and recommence in the spring. Apparently grubs of most species that feed on dung or soil can act as intermediate hosts, but it is probable that the natural hosts habitually feed on dung.

De Meillon (B.). **A Toxin from the Eggs of South African Ticks.**—*S. Afr. J. med. Sci.* **7** pp. 226–235, 1 pl., 2 graphs, 5 refs. Johannesburg, 1942. [Recd. 1943.]

An account is given of the discovery that a substance toxic to guineapigs was present in eggs of *Rhipicephalus evertsi*, Neum., *Boophilus annulatus decoloratus*, Koch, and *Haemaphysalis leachi*, Aud., from Johannesburg and *H. leachi* from Lorenzo Marques [*cf. R.A.E.*, B **29** 158 etc.]. The signs of toxaemia produced in guineapigs by subcutaneous injection of suspensions of eggs in normal saline filtered and collected under aseptic conditions are described in detail. They were quite different from those of tick paralysis, which in South Africa is associated with *Ixodes pilosus*, Koch, and *I. rubicundus*, Neum. [**11** 157]. Only one of 67 guineapigs became paralysed, and it is considered highly improbable that the toxin causing tick paralysis and that found in the eggs are closely related [*cf.* **19** 180; **24** 246; **27** 149]. The toxin was shown to be present in the eggs from the time they were laid until they were ready to hatch and is thought to exist in the eggs of probably all Ixodids. Experiments are described as a result of which it was concluded that the toxin is a protein and that it can be denatured by heating to 100°C. [212°F.]. Guineapigs that had recovered from the effects of the egg toxin were not immune from South African tick-bite fever.

Chatterjee (B.). **Pyrexia due to Beetle Infection.**—*Indian med. Gaz.* **78** no. 2 p. 96, 1 ref. Calcutta, 1943.

A beetle of the genus *Caccobius* was recovered in Assam from the faeces of a child 1½ years old [*cf. R.A.E.*, B **28** 4] who had had continued fever for two weeks and was suffering from infection of the urinary tract with *Bacillus coli*. Two similar beetles had been passed a few days before but flew away before they could be caught. Following treatment for the urinary infection, the boy's temperature became normal at the end of the third week, but it remained so for only three days and then rose to about 102°F. At the end of another week, it had changed only slightly although only a few pus cells and no *B. coli* were present in the urine. It is suggested that the continued high temperature may be attributable to the infestation of the intestines by the Coprid.

Chang (K.). **Domestic Flies as mechanical Carriers of certain human intestinal Parasites in Chengtu.**—*J. W. China Border Res. Soc.* (B) **14** pp. 92–98, 7 refs. Chengtu, 1943.

During the summers of 1938 and 1939, 3,076 flies were caught in Chengtu and examined to ascertain the extent to which they were carrying intestinal parasites of man. Trophozoites or cysts of protozoa and eggs of helminths indistinguishable from those of species that infest man were recovered from the intestinal contents or excreta of a considerable proportion of them. The numbers of which the intestinal contents were examined individually and (in brackets) the numbers positive were 146 (60) of *Chrysomyia megacephala*, F., 68 (4) of *Lucilia sericata*, Mg., 42 (2) of *Sarcophaga* spp., 153 (0) of *Musca domestica vicina*, Macq., and 16 (0) of other species.

MENG (Ch'ing-hua). **Notes on the Diptera of Medical Importance in Chengtu.**—*J. W. China Border Res. Soc.* (B) **14** pp. 99–101, 4 refs. Chengtu, 1943.

The Diptera recorded in this paper from Chengtu are chiefly mosquitos, Muscids and blowflies. *Culex fatigans*, Wied., and *Armigeres obturbans*, Wlk., were the commonest mosquitos; the only Anophelines recorded are *Anopheles hyrcanus* var. *sinensis*, Wied., and *A. barbirostris*, Wulp.

WADLEY (F. M.) & SULLIVAN (W. N.). **A Study of the Dosage-mortality Curve.**—*J. econ. Ent.* **36** no. 3 pp. 367–372, 2 figs., 11 refs. Menasha, Wis., 1943.

The basic assumptions in the transformation of percentage mortality to probits and of concentrations to logarithms in the dosage mortality curve [*cf. R.A.E.*, A **22** 440] are that increase in concentration takes effect logarithmically and that susceptibility is normally distributed among individuals. Since these assumptions indicate that 100 per cent. mortality will not be attained by any finite concentration and that zero mortality can occur only at zero concentration, and since the lower bend in the asymmetric sigmoid curve obtained with untransformed data is very poorly defined and there is a persistent deviation from linearity in the transformed curve, further investigations of these points were carried out. Statistical analysis of the results obtained when large numbers of house-flies [*Musca domestica*, L.] were treated with sprays of pyrethrum extract in acetone at a series of concentrations ranging from 0·031 to 5 mg. pyrethrins per cc., untreated flies and flies treated with acetone being used as controls, gave a strong indication of a definite threshold of toxic concentration, but the numbers of insects were insufficient for determining the significance of 100 per cent. mortality at the highest concentration. The lower bend in the asymmetric sigmoid curve was not well defined, and when spray concentrations were transformed to logarithms and percentages of mortality to probits, the data indicated significant and definite curvature, linearity being positively disproved in this material.

It is therefore concluded that the log-probit transformation is probably useful but not perfect, that extrapolation should be discouraged and that further study of the curve is justified.

KARTMAN (L.). **New Developments in the Study of Ectoparasite Resistance.**—*J. econ. Ent.* **36** no. 3 pp. 372–375, 13 refs. Menasha, Wis., 1943.

In experiments designed to show the effects of a deficient diet on the ability of rats to resist multiplication of *Polyplax spinulosa*, Burm. [*cf. R.A.E.*, B **28** 59], a general though indefinite, trend towards intensified infestation was observed on rats fed on ground wheat ration as compared with rats fed on a complete ration. A definite positive correlation was later shown to exist between adequate amounts of vitamin A in the ration and resistance to lice. In the course of these experiments, rats maintained on a diet deficient in vitamin A and artificially infested with an average of 22·3 lice per rat developed an average infestation of 1,451·4, while others infested with 26·7 lice and given a curative treatment showed only 28·2 and control rats infested with 23·5 lice harboured 12·5. Certain rats with sufficient storage of vitamin A showed a tendency to increased infestation when suffering from respiratory infections, diarrhoea, abscesses or generalised infections, but P. György found that although infestation was apparent on about 20 per cent. of rats kept on a diet free from riboflavin (vitamin B_2) for 8–10 weeks, most of the infested rats were by no means weakened or inactive, and heavy infestations were not observed even in moribund rats ill with B_6 deficiency or with a variety of severe complaints if they had not been fed on diets free from riboflavin. This is thought to indicate that riboflavin may have a more direct and specific relation to immunity from

ectoparasites than vitamin A, and it has been suggested that since members of the vitamin B_2 complex are linked with sulphur metabolism, this may be the way in which riboflavin influences lice. Attempts to induce resistance to ectoparasites by feeding sulphur to fowls have not given conclusive results [*cf.* **32** 7, etc.], and it has also been found that if man swallows sulphur, some of which is excreted epidermally as hydrogen sulphide, there is no effect on *Pediculus humanus*, L. Aspects of the relation between specific dietary factors and resistance to ectoparasites on which study is desirable are suggested.

LATTA (R.) & YEOMANS (A. H.). **Methods and Equipment for Fumigation of Clothing infested with Body Lice.**—*J. econ. Ent.* **36** no. 3 pp. 402–404, 4 figs. Menasha, Wis., 1943.

Descriptions are given of two types of equipment for fumigating clothing with methyl bromide to destroy body lice [*Pediculus humanus*, L.] under service conditions. Methyl bromide was the only one of several common fumigants found to be effective at short exposures. Moreover, it was effective at temperatures down to that at which exposure to cold for the same period was lethal, it left no objectionable odour, did not damage clothing or equipment and was relatively safe to use. After fumigation, clothing could be freed from an injurious amount of absorbed gas by shaking in the open air and worn immediately without danger of skin irritation or injury from inhalation.

The first type, designed for use at base, is a cabinet composed of panels of half-inch plywood bolted together, and has a capacity of 250 or 330 cu. ft. On the back are a motor-driven blower at floor-level, a duct leading from the blower towards the ceiling and a vent at the end of the duct, which, when open, diverts the air stream to the exhaust system. The blower thus circulates the gas during fumigation and provides for venting afterwards. The joints are sealed with a non-hardening bituminous compound, and the door and vents fit against sponge-rubber gaskets. The clothing is placed in bags on removable racks with about six inches clearance between each layer. The fumigant is released into the air stream above the blower from a 1 lb. container by a proprietary device. Less than 10 minutes are required to load and close the vault and the same time to clear the gas from it to allow of unloading.

The second type of equipment consists of bags of relatively gas-tight material coated with ethyl cellulose or neoprene, each designed to hold one soldier's uniform and blankets. The top edge is reinforced, and the bag is closed by folding it three times and securing it with tapes. A glass ampule of fumigant in cloth casing is placed in a special pocket and broken after the bag is closed. Fumigated clothing can safely be worn after airing for 5 minutes in a well-ventilated place.

HULL (J. B.), SHIELDS (S. E.) & PLATTS (N. G.). **Diking as a Measure for Sand Fly Control in Salt Marshes.**—*J. econ. Ent.* **36** no. 3 pp. 405–409, 4 figs., 3 refs. Menasha, Wis., 1943.

PLATTS (N. G.), SHIELDS (S. E.) & HULL (J. B.). **Diking and Pumping for Control of Sand Flies and Mosquitoes in Florida Salt Marshes.**—*T. c.* pp. 409–412, 2 figs., 1 ref.

In the first paper, the authors record observations on the effectiveness of diking and pumping between July 1939 and November 1941 inclusive in the control of *Culicoides* spp. in salt marshes in Florida supporting a heavy growth of mangrove and pickleweed [*Batis maritima*] that had been previously ditched for the control of mosquitos [*cf. R.A.E.*, B **27** 217]. Samples of soil, each 1 U.S. quart in volume, were collected, and recovery cages 2 ft. square and 1 ft. high were placed in the ditches and 5, 10, 20, 40 and 75 ft. away in diked and undiked marshes. Between July 1939 and September 1940 inclusive, an

average of 28·98 larvae of *Culicoides* per sample was isolated from undiked marshes and 2·87 from diked marshes. Between November 1940 and November 1941 inclusive, when less water was pumped from the diked area, the corresponding figures were 26·02 and 7·04, respectively. The percentage reduction was smallest in the ditches. The adults taken in the cages in the diked marshes represented only 9·35 per cent. of the numbers collected in those in the undiked marshes in 1939–40 [*cf.* **30** 195] and 17·22 per cent. in 1940–41, when no special effort was made to dry the diked marshes.

In the second paper, descriptions are given of the dikes and their construction, and of the impeller pumps and the tide-gate installations that were found most satisfactory in the work on the control of mosquitos and *Culicoides*. The costs of construction and operation are analysed.

CREIGHTON (J. T.), DEKLE (G. W.) & RUSSELL (J.). **The Use of Sulfur and Sulfur Compounds in the Control of Poultry Lice.**—*J. econ. Ent.* **36** no. 3 pp. 413–419. Menasha, Wis., 1943.

The following is largely based on the authors' summary of this account of investigations in Florida in 1939, 1940 and 1941 on the use of sulphur for the control of Mallophaga on fowls [*cf. R.A.E.*, B **32** 7]. Sulphur administered internally in capsules was ineffective, and only limited control resulted when 5–10 per cent. sulphur by weight was added to a balanced mash feed given in a way that provided ample opportunity for external contamination. When the mash was given in hoppers, control was greatest in the region of the neck. Fowls that were dusted with the 10 per cent. mash feed were freed from lice. This indicated that sufficient contamination would result in control, but field tests of feeding on a mash containing sulphur did not give promising results. External application of dusting sulphur gave complete control, and partial or complete control was effected by adding dusting sulphur to the soil at 5–10 lb. per 100 sq. ft., but when the fowl run was raised 2 inches from the soil on a wire netting base, there was no control. In a test on a larger scale, in which the soil was treated with sulphur at 5 lb. per 100 sq. ft. and the house dusted with 5 lb. sulphur every 10 days, no control was effected, but when the soil and house were treated with 10 and 5 lb. sulphur, respectively, at the same interval there was a decrease in infestation after the first application, and 10 of the 15 birds were free from lice at the third weekly inspection and all except two at the fourth. If the fowls are confined to a house and a dust bath is provided, good control can be obtained by incorporating 10 per cent. dusting or flour sulphur in the bath. Treatment of sawdust with sulphur gave similar control to treatment of soil. Dips of 5–8 lb. wettable sulphur per 100 U.S. gals. water or 1 gal. 32° Baumé lime-sulphur concentrate in 60–100 gals. water were very effective and gave complete control in 1–2 weeks, but residues were not permanent enough to protect fowls from reinfestation from heavily infested birds.

RICHARDSON (H. H.). **Studies of Methyl Bromide, Chloropicrin, certain Nitriles and other Fumigants against the Bedbug.**—*J. econ. Ent.* **36** no. 3 pp. 420–426, 28 refs. Menasha, Wis., 1943.

The following is substantially the author's summary. Tests were made of 26 chemicals or mixtures of chemicals as fumigants against the eggs, nymphs and adults of *Cimex lectularius*, L., in 12-litre glass flasks. Some of the more toxic were also tested in a steel cylinder with a capacity of 7·7 cu. ft. About 150 tests of fumigation for five hours at 77±0·9°F. were made with some 15,000 eggs and 30,000 nymphs and adults. Hydrocyanic acid gas was found to be the most toxic fumigant when tested in flasks. The next most toxic were acrylonitrile alone and mixed with carbon tetrachloride, chloroacetonitrile,

chloropicrin and dichloroethyl ether, while 1,1-dichloro-1-nitroethane, methyl bromide, di- and tri-chloroacetonitrile and ethylene oxide were slightly less toxic. The addition of carbon tetrachloride to acrylonitrile (1 : 1 by volume) to produce a non-inflammable mixture also increased its effectiveness. Chloropicrin was more effective against the eggs than against the older nymphs and adults, though it has been reported as being less so [*cf. R.A.E.*, B **27** 167]. The second to fifth instars were generally the most resistant stages and the eggs the least so, but the eggs were the most resistant to dichloroethyl ether, tricloroethylene and some of the less toxic substances. Trichloroethylene had an anaesthetic action on the active stages. In tests with the more toxic materials in an unloaded steel cylinder, efficiency was just as great against insects protected by 6–8 layers of cotton batting as against those exposed directly to the gas. In a loaded steel cylinder, methyl bromide and chloropicrin were the most effective gases when used at a dosage of 16–20 oz. per 1,000 cu. ft. against bugs wrapped in cotton batting or in woollen blankets exposed directly to the gas or packed in the centre of a bag containing 25 lb. clothing (3 lb. per cu. ft. of cylinder space). Hydrocyanic acid gas appeared slightly less effective, followed in approximate order of decreasing efficiency by acrylonitrile mixed with carbon tetrachloride, trichloroacetonitrile, 1,1-dichloro-1-nitroethane, ethylene oxide and chloroacetonitrile.

Smith (L. E.) & Melvin (R.). **The Toxicity of some heterocyclic Compounds to young Screwworms.**—*J. econ. Ent.* **36** no. 3 pp. 475–476, 2 refs. Menasha, Wis., 1943.

Three dibenzo derivatives of five-membered heterocyclic compounds (dibenzofuran, dibenzothiophene and dibenzopyrrole) were found to differ widely in their toxicity to larvae of *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.), the minimum lethal concentrations of the first two, as determined by a method already noticed [*R.A.E.*, B **29** 83], being 0·05–0·08 and 0·03–0·05 per cent., respectively, while the last was non-toxic. It was therefore decided to test the six-membered heterocyclic compounds containing all possible combinations of oxygen, sulphur and the imino (NH) group, each in the para position to the other. The toxicity of each of the compounds is given. There was no apparent relation between physical properties and toxicity. Compounds containing one sulphur atom in the heterocyclic ring were toxic (all having a minimum lethal concentration of 0·03–0·05 per cent.), but the one containing two sulphur atoms was not. The addition of the second imino group to dibenzopyrrole produced the most toxic compound (dihydrophenazine), with a minimum lethal concentration of 0·01–0·025 per cent.

Ewing (H. E.). **A second introduced Rat Mite becomes annoying to Man.**—*Proc. helminth. Soc. Wash.* **9** no. 2 pp. 74–75, 2 refs. [Washington, D.C.] 1942. [Recd. 1944.]

Allodermanyssus (*Dermanyssus*) *sanguineus*, Hirst, which was described from Egypt [*R.A.E.*, B **3** 47], was collected in the District of Columbia in 1909 and was recorded again in the United States on six occasions in 1938–41. It was found once on a mouse (*Mus musculus*) in Arizona, four times in buildings in the District of Columbia, New York City and Philadelphia, and once on merchandise imported into New York from Georgia. In one instance, a female was taken on man, and in another, the mites were reported to be causing a rash. The characters distinguishing *A. sanguineus* from *Dermanyssus gallinae*, Deg., are given.

PRINCE (F. M.). **Species of Fleas on Rats collected in States west of the 102d Meridian and their Relation to the Dissemination of Plague.**—*Publ. Hlth Rep.* **58** no. 18 pp. 700–708, 8 refs. Washington, D.C., 1943.

During 1935–41, 5,785 fleas were taken on 4,188 rats that were trapped or shot in rural areas and cities in 13 of the United States west of 102°W. long. Rats appeared to be widely distributed throughout the area. Those taken were *Mus* (*Rattus*) *norvegicus*, *M.* (*R.*) *rattus* and *M.* (*R.*) *rattus alexandrinus*. A list is given of the 21 species of fleas found, many of which are normally parasites of field rodents, and tables show the numbers of the three rats taken and of fleas of each species and unidentified fleas examined for plague from various localities in the different States, with an indication of the environment in each case. *Xenopsylla cheopis*, Roths., the most efficient vector of plague from rat to rat, was found in the interior of five States and in the coastal cities of two. *Ceratophyllus* (*Nosopsyllus*) *fasciatus*, Bosc, also an efficient vector, occurred in 12 States. Nine of the species of fleas collected, including these two, have been found capable of transmitting plague under experimental conditions by biting hosts on which they do not occur in nature [*cf. R.A.E.*, B **28** 27; **30** 33], and one other, *Echidnophaga gallinacea*, Westw., has been found infected in nature [**30** 37]. Plague was not found in the rats collected, but it has been demonstrated in wild rodents or fleas from wild rodents in 11 of the 13 States, and observations on the migrations of urban rats have shown that they can come into contact with rodents of the fields and woods. Infected rats (*M. norvegicus*) were discovered in the San Francisco Bay region of California in 1941, and plague has recently been demonstrated in several collections of fleas from rats in the same region. Infection was also found in fleas from rats taken in Washington in October 1942, and infected fleas and rat tissues have been detected with increasing frequency since that date. There is evidence of an increase in the rat population of some urban areas in the western States in recent years.

MEYER (J. R.). **O alho no tratamento do berne.** [The Use of Garlic against the Larvae of *Dermatobia hominis*.]—*Biológico* **9** no. 7 pp. 163–168, 3 figs. São Paulo, 1943.

The author gives an account of tests in Brazil in which larvae of *Dermatobia hominis*, Say, infesting oxen, dropped in numbers to the ground after the animals had ingested powdered garlic. In one experiment, 99 of 120 larvae counted on four oxen each given a drench of water containing 100 gm. garlic dropped within 96 hours, whereas only 1 of 35 larvae dropped from three untreated animals. In another experiment, 50 per cent. of the larvae dropped from oxen fed on bran to which 50 gm. powdered garlic per head had been added, as compared with 10 per cent. in the controls.

CHORLEY (J. K.). **Tsetse Fly Operations, 1942. Short Survey of the Operations by Districts for the Year ending December, 1942.**—*Rhod. agric. J.* **40** no. 3 pp. 174–177; also as *Bull. Minist. Agric.* [*S. Rhod.*] no. 1232, 4 pp. Salisbury, S. Rhod., 1943.

More cases of trypanosomiasis of cattle were diagnosed on the eastern border of Southern Rhodesia (Melsetter District) in 1942 than in any previous year, and more farms were involved [*cf. R.A.E.*, B **31** 40]. The total number of tsetse-flies caught on the Rhodesian side of the border was 25, comprising 8 males and 8 females of *Glossina pallidipes*, Aust., and 5 males and 4 females of *G. brevipalpis*, Newst., while 16 males and 15 females of *G. pallidipes* and 5 males and 4 females of *G. brevipalpis* were caught in the clearing in Portuguese East Africa. A heavy concentration of *G. morsitans*, Westw., was

found in Portuguese East Africa on the Busi River east of Chipinga, about six miles from the border, and a few individuals were taken within half a mile of the border. This will necessitate extensive widening of the border clearing and other auxiliary measures to protect the threatened stock-farming area. There is little game on the Rhodesian side of the border except small buck and pig, but there is a large cattle population running under semi-ranch conditions. *G. morsitans* was not taken in the Sabi Valley inside Southern Rhodesia, but one individual was taken within a mile of the border.

G. pallidipes was discovered on the Sebungwe, Maseme and Matibi Rivers in the north-east of the Wankie district and on the Nagupandi River in the south-west of the Sebungwe district. It was not previously known that any species other than *G. morsitans* occurred in the northern fly belt. The area involved is known to cover several hundred square miles and is assumed to be much greater. Fairly heavy losses of stock that have recently occurred in the Wankie district may possibly be attributable to the spread of *G. pallidipes*. Two cases of sleeping sickness discovered near Chirundu on the Zambesi River are the first cases recorded from the Lomagundi fly belt.

It was decided to consolidate operations in the northern fly belt, without attempting new extensive reclamation for three years, and all game fences were dismantled. The situation in individual districts is briefly reviewed.

ROBINSON (P.). **Typhus Fever in Addis Ababa.**—*Ann. trop. Med. Parasit.* **37** no. 1 pp. 38–41, 13 refs. Liverpool, 1943.

This report on typhus in Addis Ababa, where it is transmitted by the body louse [*Pediculus humanus*, L.], is based on observations on 400 cases made between 15th May 1941 and the end of January 1942. Though an attack of typhus is said to confer immunity for life, there is reason to believe that this is not so in Addis Ababa, for not only did patients often claim to have suffered from the disease before, but, as typhus is endemic in Abyssinia and lice are to be found everywhere, the disease would be likely to be one of childhood if it were followed by lifelong immunity.

LEWIS (D. J.). **Mosquitoes in Relation to Yellow Fever in the Nuba Mountains, Anglo-Egyptian Sudan.**—*Ann. trop. Med. Parasit.* **37** no. 1 pp. 65–76, 3 pls., 1 map, 17 refs. Liverpool, 1943.

Observations on the mosquito fauna of the Nuba Mountains district of Kordofan Province in the Anglo-Egyptian Sudan, where an extensive rural epidemic of yellow fever occurred in 1940 [*R.A.E.*, B **29** 115; **30** 88], were made in November and December 1940 and January 1941 in many parts of the eastern area and in the following rainy season (May onwards) chiefly near Heiban. No great volume of standing water is found in the district even in the rainy season, but there are some small swamps and a few ground pools, and, among the hills, thousands of small pools made artificially in the rocks near dwellings in the process of grinding sesame for oil. Water stands in these and in holes in trees and the axils of certain plants. In the dry season, only a little water remains in a few small streams, pools in swamps and water-courses, wells and domestic containers. A list is given of the 55 species and varieties of mosquitos known to occur in the Nuba Mountains. They include 18 species of *Aëdes*, and members of this genus formed 99 per cent. of the mosquitos caught biting man. In the dry season, great numbers of larvae of *Anopheles pretoriensis*, Theo., and some of *Culex ethiopicus*, Edw., are found in residual pools in water-courses, larvae of *A. rufipes*, Gough, and *A. macmahoni*, Evans, in swampy pools and those of *C. tigripes*, Grp., and *C. duttoni*, Theo., in water-holes. Species of *Aëdes* appear when the rains begin, usually in May, and the commonest breed in rock-pools and tree-holes. Anophelines are not common until later.

All but two of 50 mosquitos collected in seven houses in September and October were Anophelines, and 32 of them were *Anopheles gambiae*, Giles. Very few mosquitos are seen after October. In 1940, a male of *Aëdes furcifer*, Edw., was collected on 8th November.

The larvae obtained from rock-pools, tree-holes and domestic breeding places and the adults caught biting near Heiban are shown in tables, and *A. aegypti*, L., and the five common biting mosquitos, all species of *Aëdes*, are considered individually. All are experimental vectors of yellow fever [**16** 236 ; **17** 213 ; **31** 21] except *A. furcifer*. *A. aegypti* was observed to breed indoors in the dry season of 1940–41. The percentage of houses in the south-eastern area in which larvae were found was 8·3. It was 0 in most villages and was never over 30. Indoor breeding in the rainy season was observed in the Heiban area, and larvae were found in 6 out of 205 collections from rock-pools at this season and in 12 out of 104 collections from tree-holes. Adults were seen only three times during a period of many weeks in the dry season, and only once during searches of houses for larvae during the rains. Of 1,305 mosquitos caught biting out of doors, usually near houses, only 16 were *A. aegypti*. So far as is known, it is rare in most parts of the south-eastern area in the dry season, except in the Moro Hills, where it is common but not abundant. It abounds at Tagoi and Kau, and occurs in the Heiban area and at Sheikh Karim, during the rains, but is not abundant there. It is considered most unlikely that this species, which was unusually scarce and has a small range of flight, was the chief vector of yellow fever, except in certain localities such as some of the Moro villages and houses near an old sesame oil press at Heiban. The principal vector appeared to be *A. vittatus*, Big. [**30** 88], the adults of which are abundant on and near hills. It formed 34 per cent. of the adults taken biting in evening collections in June and July and less than 5 per cent. in later months. It was the only common day-biting species out of doors during the rains. The larvae occurred in great numbers in the rainy season in rock-holes and to a smaller extent in other breeding places. In June, they were preyed on by dragonfly nymphs, which were probably responsible for the decrease in the mosquito's numbers in the second half of the wet season. The dry season is passed in the egg stage in dust in rock-holes. As it is not always possible to separate *A. furcifer* and *A. taylori*, Edw., they are considered jointly and are deemed to be next in importance to *A. vittatus*. Adults were numerous almost everywhere and comprised more than half of all females caught while biting. It is thought that they either fly very actively or live very long. They breed in tree-holes and may have been particularly important in transmitting the disease where few rock-holes exist, particularly as Nuba villages and dwellings are usually scattered among trees. *A. luteocephalus*, Newst., also a tree-hole breeder, was common on and near hills, where it bit after dusk. It is thought to be of some importance there, but was seldom seen biting more than a few hundred yards from hills. Few larvae were found. *A. metallicus*, Edw., the species most often found breeding in tree-holes, is a poor flier. It was common within a few yards of its breeding places and probably had some importance as a vector near them. *A. simpsoni* var. *lilii*, Theo., and *Mansonia* (*Taeniorhynchus*) *africana*, Theo., the other experimental vectors [*cf.* **17** 213 ; **18** 147] among the species taken, were uncommon and are thought to be of little or no importance. Brief notes are given on some of the other mosquitos caught. Apart from mosquitos, the common biting insects in the Heiban area were *Cimex hemiptera*, F., *C. lectularius*, L., and *Ctenocephalides* sp., but experiments have indicated that the virus of yellow fever would persist for only a short time in them [**20** 270 ; **22** 250].

The cause of the epidemic is unknown, but it probably broke out in the Moro Hills. This was the only area where *A. vittatus* was found breeding in the dry season and although *A. aegypti* was not abundant, the index was higher than at most places visited, probably because large vessels are used for storing water in

this district and are seldom emptied [*cf.* **31** 214]. Although the rainfall for the season was considerably below the average, that for May was nearly twice the average and the second highest for 26 years. This did not apply to the Nuba Mountains as a whole. Most of the Nubas live on or near rocky hill slopes near cultivated terraces interspersed with artificially pitted boulders and small trees in which many potential vectors breed. At present, control of yellow fever by measures against mosquitos is impracticable in the rural parts of the Nuba Mountains, and the work of preventing them from acting as a potential focus for the spread of yellow fever must be done mainly outside the area. Many of the Nubas are leaving the hill slopes for the plains. If this movement continues, much of the population will live far from the principal haunts of *A. vittatus* and the clearing of land will reduce the numbers of tree-hole breeding *Aëdes*. Many rock-pools, most of which are near dwellings, could be filled with fine gravel, which becomes bound by the roots of small plants. The removal of hollow trees and the control of breeding of *Aëdes* in houses are thought to present little difficulty.

Schwetz (J.). **Sur une épidémie mystérieuse, suspecte et soupçonnée de paludisme, constatée dans une agglomération indigène d'un très haut plateau du Ruanda.**—*Ann. Soc. belge Méd. trop.* **21** no. 1 pp. 37–60, 1 map. Brussels, 1941. (With a Summary in Flemish.) [Recd. 1944.]

An epidemic that began early in 1938 and continued into 1939 at a village in Ruanda at an altitude of about 6,200 ft. was ascribed locally to malaria, but during an investigation in September 1939, the author failed to find any Anophelines in dwellings. On the edge of a lake, about 500 ft. lower down, he found larvae of *Anopheles paludis*, Theo., and *A. christyi*, Newst. & Cart., both of which are known to be of no importance as vectors. Spleen and blood examinations gave no clear indication as to the nature of the disease.

Schwetz (J.) & Baumann (H.). **Recherches sur le paludisme dans les camps miniers de la division de Kadubu-Mufwa de la Minière des Grands Lacs (M.G.L.) et dans les camps miniers du secteur de la Lubimbe du Comité National du Kivu (C. N. Ki.), (District du Kivu).**—*Ann. Soc. belge Méd. trop.* **21** no. 2 pp. 87–128, 1 map. Brussels, 1941. (With a Summary in Flemish.) [Recd. 1944.]

Details are given of a malaria survey carried out in 1939 in mining camps on the western slopes of the high plateaux west of Lake Kivu, Belgian Congo. In the Kadubu group there was severe endemic malaria, *Anopheles gambiae*, Giles, was caught in fairly large numbers, and *A. funestus*, Giles, was also present. Larvae and pupae of *A. gambiae* were collected in neighbouring ravines and valleys. In one malarious locality, however, no adult mosquitos were taken and no Anopheline larvae were found in the surrounding ravines. The Lubimbe group was a typical region of low endemic malaria, and Anophelines were extremely rare. Below one camp, some larvae of *A. gambiae* were found in a channel dug from a small river and some adults of the same species in a food store nearby.

Schwetz (J.). **Note sur le paludisme à Irumu (Ituri, Congo belge).**—*Ann. Soc. belge Méd. trop.* **21** no. 3 pp. 221–224, 1 ref. Brussels, 1941. (With a Summary in Flemish.) [Recd. 1944.]

Malaria is endemic at Irumu, the capital of the district of Ituri, situated at an altitude of about 3,000 ft., but examination of children in October 1939 showed lower rates of infection than in 1933. The only Anophelines found were *Anopheles gambiae*, Giles, and *A. funestus*, Giles. Adults were rare in the houses of Europeans, but fairly numerous in native dwellings.

VAN DEN BERGHE (L.). **Recherches sur l'onchocercose au Congo belge. 1er mémoire. La transmission d'***Onchocerca volvulus* **par les simulies.**—*Ann. Soc. belge Méd. trop.* **21** no. 1 pp. 63–76, 3 pls., 8 refs. Brussels, 1941 ; **IIe mémoire. Les vers adultes et leur localisation chez l'homme.**—*T. c.* no. 2 pp. 167–187, 1 pl., 27 refs. ; **IIIe mémoire. Les aspects cliniques de l'onchocercose humaine.**—*T.c.* no. 3 pp. 261–291, 3 pls., 4 pp. refs. (With Summaries in Flemish.) [Recd. 1944.]

Of these three papers, in which the author records his observations in 1936 on onchocercosis in the Uele region of the Belgian Congo, the first deals with Simuliids, of which all those taken and identified proved to be *Simulium damnosum*, Theo. Brief notes are given on their habits and breeding places. The adults are most readily found close to the streams where breeding takes place, but occurred after rain at distances of up to about 1,000 yards from them. The females bite mostly between 6 and 8 a.m. and at dusk, though they continue to do so throughout the day in the shade. They seldom bite at a height greater than about 3 ft. above the ground. Children placed on a table were rarely attacked, but others standing beside it were bitten on the ankles and legs. Boys were bitten on the ankles and legs when standing, and on all parts of the body, even the head, when squatting on the ground. The species of *Simulium* that are the presumed vectors of *Onchocerca volvulus* (*caecutiens*) in Guatemala and Mexico usually attack man on the head, and this difference in feeding site is no doubt responsible for the differences in the localisation of *O. volvulus* in the human body and its clinical manifestations in Africa and America [*cf. R.A.E.*, B **21** 85, etc.].

In order to ascertain the rates of infection with *O. volvulus* among Simuliids in nature, catches were made on individuals showing no palpable nodules or microfilariae in the skin, and the results are given of the dissection of 1,945 flies so caught in four localities. The larvae found were of three types, namely, those in the gut, which do not differ from the microfilariae in the human skin, developmental forms in the sausage stage in the thoracic muscles, and the so-called infecting larvae, which occurred mostly in the thoracic muscles, alone or with sausage forms, and also in the mouth-parts, proboscis and labium and occasionally near or in the Malpighian tubes. The numbers of larvae per fly ranged from 2 to 38, and larvae were uncommon in the gut, probably because the flies could not acquire them from the persons on whom they were taken. The author considers that rates of infection of Simuliids should be given for larvae in each of the last two stages, and that larvae in the gut should not be included, since it cannot be known whether they will develop to the later stages. Among the flies from the four localities, 13·3, 18, 8·5 and 7·3 per cent. were infected, respectively, 10, 17, 0 and 1 per cent. with sausage forms and 5, 8, 8·5 and 7 per cent. with infecting larvae.

SCHWETZ (J.), BAUMANN (H.), BEUMER (Mme) & FORT (M.). **Sur le paludisme endémique dans la vallée de la Semliki et sur les rives du Lac Albert.**—*Ann. Soc. belge Méd. trop.* **21** no. 4 pp. 339–373, 1 map, 2 refs. Brussels, 1941. (With a Summary in Flemish.) [Recd. 1944.]

The results are given of a malaria survey in 1939 in the valley of the Semliki and at Kasenyi, on Lake Albert, in the Belgian Congo. The Anophelines taken in the valley were *Anopheles gambiae*, Giles, which predominated, and *A. funestus*, Giles. Low endemic malaria occurred among the inhabitants of the six villages visited ; these ranged from 2,600 to 6,300 ft. in altitude, and Anophelines were taken in only two of them, at 2,600 and 3,600 ft. The higher villages were less malarious than the lower ones. The valley is surrounded by plateaux of up to 6,600 ft. in altitude, and no malaria was found in a village there.

At Kasenyi, where malaria was also endemic, *A. pharoensis*, Theo., and *A. funestus* were more abundant in houses than *A. gambiae*. Larvae of these species and also of *A. coustani*, Lav., and *A. symesi*, Edw. (one example) were taken.

CAUSEY (O. R.), PENIDO (H. M.) & DEANE (L. M.). **Observations on Malaria in the Presence and Absence of *Anopheles gambiae* in an experimental Area (Cumbe) Ceará, Brazil.**—*Amer. J. trop. Med.* **23** no. 1 pp. 59–71, 2 refs. Baltimore, Md., 1943.

As a part of the programme for the eradication of *Anopheles gambiae*, Giles, from Brazil [*R.A.E.*, B **31** 215], the isolated district of Cumbe in the lower Jaguaribe valley, Ceará, where breeding places were abundant, was set aside for experimental study. Breeding was allowed to continue unimpeded from September 1939 to April 1940, and medication was stopped for the last two weeks of 1939, but after this anti-malaria drugs were distributed on application. Control of the Anopheline by a combination of measures against the larvae and adults was resumed in May 1940, and no evidence of its presence was found after that month.

The following is based on the authors' summary of the results of a malaria survey of this isolated community made throughout 1940. The density of *A. gambiae*, the parasite and spleen rates among the human population, the incidence of malaria symptoms and demands for medication all increased during the first four months. The eradication of *A. gambiae* was accompanied by a sudden drop in the parasite rate from 85·7 per cent. in April to 19·5 per cent. in June, at which level it stayed with little variation until the end of the year, and a gradual reduction in spleen rate from 64·4 per cent. in April to 9·8 per cent. in September. Although children 1–4 and 10–14 years old showed somewhat higher parasite rates than other persons, there was on the whole little difference among the various age groups. This confirms previous information that malaria had not been endemic in the area. No consistent difference in intensity of infection, in species of *Plasmodium*, or in incidence of gametocytes was demonstrated among the age groups. Although there were many more gametocyte carriers in the months in which *A. gambiae* was present than in those in which it was not, the ratio of carriers to cases was comparable in the two periods. The spleen rate, unlike the parasite rate, showed a distinct difference among age groups, people over 40 years old having the lowest rate of splenic enlargement and children 1–14 years old the highest. No correlation was found between species of parasite and size of spleen.

CAUSEY (O. R.), DEANE (L. M.) & DEANE (M. P.). **Ecology of *Anopheles gambiae* in Brazil.**—*Amer. J. trop. Med.* **23** no. 1 pp. 73–94, 5 refs. Baltimore, Md., 1943.

Only the light-coloured form of *Anopheles gambiae*, Giles [*cf. R.A.E.*, B **20** 64, 65] breeding in fresh water has been found in Brazil. Observations on its bionomics were made on several laboratory-bred colonies and in the field. The technique of the laboratory studies is briefly described. Egg production was more prolific when a large number of females was kept in one cage (28×28×38 cm.) than when the same number was distributed in several cages. Oviposition was almost entirely confined to hours of darkness and occurred throughout the night, but observations on five nights showed that more than half the batches of eggs were deposited between 8 and 11 p.m. The average numbers of eggs laid per batch by females caught in houses and those reared in the laboratory were 192 and 94, respectively. Retention of eggs was shown not to be a contributory cause of the lower yield of the laboratory mosquitos. There was practically no difference in the percentage hatch of eggs laid by the two groups

of females. The average for all batches was 77·9. In experiments involving more than 13,000 eggs, the period between oviposition and pupation varied from 7 to 27 days. In two-thirds of the cases, it was 12–18 days. Larvae kept under favourable conditions, which are described, pupated 118–121 hours after hatching, and field experiments indicated that this is not an unusually short duration for the larval stage. Development of all immature stages was much slower in the shade than in the sun. The adverse effect of crowding was shown by placing 50, 200 and 500 eggs in pans 30 cm. in diameter. The percentages of larvae that pupated in the three pans were 82, 46 and 37·6, and the percentages that gave rise to adults 70, 41·5 and 29·8, respectively, and, while pupation was complete by the tenth day in the pan with the fewest larvae, it continued until the twentieth and twenty-first days in the more crowded pans. Data on the duration of each larval instar and the pupal stage are given from observations on a batch of 125 individuals. The shortest pupal period was 19 hours. Under practically optimum conditions of food and protection, the longest adult life was 39 days.

The field observations were made in two small districts, Cumbe [see preceding abstract] and Corrego dos Rodrigues, in which no control measures were being carried out. The former was particularly suitable. During routine observations made there in February, March and April, 100 times as many adults of *A. gambiae* were taken in houses when they had been occupied the night before as in the same houses following a night on which they had been empty. Although the rooms were usually separated only by partitions that did not extend to the ceiling, nearly four times as many adults were taken in rooms in which people had been sleeping as in rooms that had been unoccupied during the night. Ten times as many were taken in the darkest rooms visited as in the lightest. Migration from houses in a hot dry region was greater than from houses in a moist one, but even in the latter four-fifths of the mosquito population in any given house changed within 24 hours of the beginning of observations. Many of the migrating mosquitos are probably borne long distances by wind. Experiments using both human and animal baits inside and outside houses confirmed the observations made throughout the investigation that *A. gambiae* feeds only inside houses and showed that man is the preferred host.

Dissections of the three species of *Anopheles* prevalent in the experimental areas showed *A. gambiae* to be the principal vector of malaria. This species, a species of the *tarsimaculatus* series and *A. albitarsis*, Arrib., had oöcyst rates of 4·7, 1·1 and 0 and sporozoite rates of 1·6, 0·5 and 0. The low rates for *A. gambiae* may be partly due to an alteration effected in the natural rates by the capture of large numbers of adults in frequent surveys. The gametocyte rate of the population varied from 9·3 to 20·9 per cent. during the period when the dissections were made. That of the children was about 20 per cent. When houses were considered in groups, there appeared to be a direct relation between the percentages of infected mosquitos and gametocyte carriers. Six out of 66 females of *A. gambiae* dissected 7–13 days after feeding on one or other of five gametocyte carriers showed cöcysts in the stomach. Their glands were negative for sporozoites. The infected mosquitos comprised 5 of 15 and 1 of 24 fed on two carriers of *Plasmodium falciparum*; the other 27 were fed on a person who had numerous and apparently normal gametocytes of *P. falciparum*, but who had taken a single tablet of atebrin three days before, or on carriers of *P. vivax*.

The preferred breeding places of *A. gambiae* were small, shallow collections of fresh water, well exposed to sunlight, with little or no vegetation and little organic matter. In the dry season, these are found chiefly in the river beds [*cf.* **28** 194 ; **29** 58–59], but in the rainy season when the rivers offer no facilities for breeding, larvae occurred in many different kinds of deposits, even those with much vegetation and some shade. In monthly examinations of water around Cumbe, shallow wells were shown to be preferred, larvae being found in

them on almost two-thirds of the occasions on which examinations were made. Borrow-pits and small depressions round a pond were next in order of preference. The larvae did not occur in borrow-pits containing brackish water, and eggs transferred to such pits with water containing 3·1–7·4 per cent. sodium chloride failed to develop. In laboratory experiments, eggs did not hatch in a 10 per cent. solution of sodium chloride and though some hatched in 1 and 2 per cent. solutions, and a very few in a 5 per cent. solution, none of the larvae reached the second instar. In further experiments, however, salt concentrations of 0·75 and 1 per cent. seemed to have little effect on hatching and some larvae developed to the adult stage, though the percentages that did so were greatly reduced. Weaker solutions had little if any effect on development. No adults emerged in stronger solutions, and the percentage hatch fell gradually with increasing concentration up to and including 2 per cent. When caged females were given the opportunity of ovipositing on filter paper moistened with distilled water or water containing 1, 2, 5 or 10 per cent. sodium chloride, 53 per cent. of the eggs were deposited on fresh water and 33 per cent. on the 1 per cent. solution, and less than 0·4 per cent. of these remained white and failed to develop. More than 90 per cent. of the eggs deposited on more concentrated solutions remained white.

Deane (M. P.) & Causey (O. R.). **Viability of *Anopheles gambiae* Eggs and Morphology of unusual Types found in Brazil.**—*Amer. J. trop. Med.* **23** no. 1 pp. 95–101, 1 pl., 5 refs. Baltimore, Md., 1943.

Information on the time for which eggs of *Anopheles gambiae*, Giles, might survive in nature in north-eastern Brazil was desired as an aid to the determination of the minimum period for which the maintenance of precautionary control measures was necessary after apparent eradication. Observations by Stone & Reynolds [*R.A.E.*, B **28** 61] had suggested that eggs laid by certain Anophelines in Panama remained viable in damp shaded soil during the dry season. The viability of 17,200 eggs deposited by wild-caught females of *A. gambiae* was therefore tested at constant humidity in moist sand by removing batches for hatching at intervals of two days from 8 to 32 days after oviposition. The percentages hatching among eggs stored for 8, 10, 12, 14–18 and 20–32 days and among controls were 36·3, 27·4, 8·6, 0·5 or less, 0 and 83·9, respectively. Tests for viability were also made on nearly 3,000 eggs laid by laboratory-bred females and exposed to atmospheric drying in tubes of sand or mud. The tubes were kept in the shade at room temperature in an uncovered vessel. After a week, the upper portion of the sand was dry enough to show loose grains, while the mud was caked and cracked at the surface. The percentages hatching among eggs transferred to water after 8, 10, 12, 18 and 20–32 days storage in sand were 72·0, 58·3, 26·5, 1·0 and 0, and among eggs stored for corresponding periods in mud, 10·0, 2·3, 1·5, 0 and 0. The percentage hatch among controls was 76·2.

The low constant hatching rate after storage for 14–18 days suggested the existence of a particular type of resistant egg. Among 12,525 eggs deposited by females in the laboratory colonies between 7th July and 31st August 1940, 172 were found to be unusual or abnormal and similar in appearance to the winter resistant egg described by Hurlbut for *A. walkeri*, Theo. [*cf.* **27** 121, etc.]. Experiments are described in which a high percentage of eggs of this abnormal type could be produced at will by subjecting fertilised females immediately after a blood-meal to temperatures of 10 or 13°C. [50 or 55·4°F.] for three or more days. When subjection to cold was delayed until 15 hours after the blood-meal, many of the eggs laid were normal, and when it was delayed for 48 hours, all were normal. The normal and most abnormal types and some transitional forms are described and illustrated.

Causey (O. R.). **A Method for the Collection, Transportation and Study of Anopheline Eggs and Adults.**—*Amer. J. trop. Med.* **23** no. 1 pp. 133–134, 2 pls. Baltimore, Md., 1943.

A brief description is given of a method of collecting and transporting Anopheline adults and eggs adopted during a recent mosquito survey in north-eastern Brazil. Females were isolated in vials containing about 2 cc. water and stoppered with cottonwool. Those that oviposited were chloroformed and placed individually in numbered flat starch capsules. The eggs were recovered by filtering the water through a filter-paper funnel previously moistened and labelled with a number corresponding to that on the capsule. After being partly dried to prevent early hatching of the eggs, the paper was folded and the edges clamped. The papers were then packed in tins between layers of moist cottonwool and the containers were sealed with paraffin wax. The capsules were packed in boxes with information as to place, date and method of capture. Females that did not oviposit were chloroformed and preserved in pill boxes lined with naphthalene. On arrival at the laboratory, a sample of each batch of eggs was preserved by placing a strip of filter paper bearing eggs in a tube with formaldehyde fumes, tightly corked and sealed with paraffin wax. As eggs may hatch in transit if too moist or become distorted if too dry, it is advisable to preserve samples in this way in the field. The filter paper and remaining eggs (which were still viable after several days) were placed in individual enamel bowls and the larvae bred to maturity. The skins of fourth-instar larvae and pupae were preserved in 70 per cent. alcohol until they were mounted.

Townsend (C. H. T.). **On the *Nyssorhynchus* Complex (Diptera : Culicidae).**—*Ann. ent. Soc. Amer.* **36** no. 2 pp. 192–194, 7 refs. Columbus, Ohio, 1943.

The author gives a list of the 35 names that have been applied to the Anophelines of the *Nyssorhynchus* complex and suggests that it is useless to accept synonymy among them before exhaustive morphological and physiological comparisons have been made. Of those found by him on the Tapajós river in Brazil [*R.A.E.*, B **23** 16], the species of doubtful identity is considered to be *Anopheles goeldii*, Rozeboom & Gabaldon. The material also included examples doubtfully determined as *A. albimanus*, Wied.; they comprised two males reared from open ground pools, seven females on horse and 70 larvae from exposed river margin grass and ground pools. Only one mount of male terminalia remains and no positive determination can be made from it. A race of *A. albimanus* is known to be present in Venezuela [**30** 190] and is therefore likely to occur in Brazil. In support of his opinion that neither *A. goeldii* nor *A. emilianus*, Komp, can be the form described as *A. tarsimaculatus* by Goeldi [**31** 34], the author states that Goeldi's figure of the egg could not have been made from a shrivelled or distorted egg of *A. emilianus*, that this species prefers horse to human blood, and that the habits of the adults of *A. goeldii* are the same as those of *A. emilianus*. Larvae of *A. emilianus* occur in sunlit pools [**30** 146] and those of *A. goeldii* in more shaded pools and the edges of rivers.

Hurlbut (H. S.). **The Rate of Growth of *Anopheles quadrimaculatus* in Relation to Temperature.**—*J. Parasit.* **29** no. 2 pp. 107–113, 3 figs., 4 refs. Lancaster, Pa., 1943.

Anopheles quadrimaculatus, Say, was reared at constant temperatures of 82, 74 and 64°F. Rearing was unsuccessful at 53°F., but eggs and pupae completed their development. With an assumed developmental zero of 50°F., the numbers of degree-hours necessary for development of eggs and pupae, and of degree-days

for the life-cycle from egg to adult were calculated as 1,074–1,509, 930–1,262 and 374–516, respectively. The thermal constant for complete development, obtained by averaging the figures for 74 and 82° but ignoring those at 64°F., was 386 degree-days. Observations on development under outdoor conditions in northern Alabama were made from March to October, inclusive, in 1941. Larvae were reared in a natural breeding place in cages fitted into an opening in a raft. Complete development required from 465 to 606 degree-days (based on water temperatures), the average being 530. While considerable variation was observed, temperature summation based on maximum and minimum daily temperatures appeared to provide a working basis for prediction.

During July, August and September, fourth-instar larvae were often found in a natural breeding place 6–8 days after it was filled with water. E. H. Hinman found in another study that the instars of *A. quadrimaculatus* tend to show successive peaks of abundance, a peak for fourth-instar larvae occurring 7–9 days after one for the first instar. The calculated mean duration of larval development in summer, which was about 12 days, accords with these observations if 3–4 days are added for the incomplete first and fourth instars. The first generation reared at outdoor temperatures in this study was derived from overwintering females [*cf. R.A.E.*, B **28** 222]. They oviposited on 23rd March, and the generation was completed on 25th April. A second generation started on 27th April was completed on 20th May, about the time when adults first appeared in significant numbers in nature. It is suggested that the first marked increase in numbers of adults in spring indicates the appearance of the second generation. As low temperatures delay the development of eggs deposited early in the season, batches laid at widely differing dates at that time would tend to mature almost together. Larvae that hatched before daily average surface water temperatures consistently exceeded 50°F. did not survive well. It is concluded that temperature summation should make it possible to forecast the seasonal reappearance of *A. quadrimaculatus* in significant numbers, and that it probably passes through 9–10 generations annually in northern Alabama. The minimum duration of stages should be considered in the application of control measures ; 441 degree-days for complete development and 305 for the larval stage, with a zero of 50°F., are the suggested figures.

PETERS (H. T.). **Studies on the Biology of *Anopheles walkeri* Theobald (Diptera : Culicidae).**—*J. Parasit.* **29** no. 2 pp. 117–122, 4 figs., 10 refs. Lancaster, Pa., 1943.

Observations made in 1940 and 1941 showed *Anopheles walkeri*, Theo., to be very common in the Mississippi valley in the south-eastern part of Minnesota [*cf. R.A.E.*, B **29** 167], and its bionomics were studied in a locality that was very suitable for breeding owing to extensive sloughs and marshes. The materials and methods used are described. The measurements of both the summer and winter eggs are given [*cf.* **27** 121–122], together with morphological notes by means of which the larvae, pupae and adults may be distinguished from those of other local Anophelines. Most of the larvae studied conformed to the so-called southern race [**25** 27]. The four instars were readily distinguished in the field by measurement of the head capsules. Light-trap catches were made nightly between 23rd April and 30th September 1940 and 2nd May and 31st October 1941, and the instars of all larvae taken in 1941 were determined. Only winter eggs were taken in 1941 until 9th April, when a few first-instar larvae were obtained. The first adults appeared in the trap on 20th May, and subsequent flights occurred in the latter part of June, between 20th July and the first week in August and between 20th August and the end of the season in October. Collections of larvae showed an increased proportion of fourth instars just before each flight of adults appeared and an increase in the first instars immediately after. Over a period of 30 days, 32 males and 83 females

were taken in a trap placed over a square metre of water in the breeding area. Over a period of one week, 5 males and 16 females emerged during the night and 2 males and 22 females during the day.

Development from winter egg to adult in the laboratory required 58, 42, 31 and 21 days at 15, 20, 25 and 30°C. [59, 68, 77 and 86°F.], respectively. Larvae hatched at 35°C. [95°F.], but died in the first instar. Winter eggs were maintained in the laboratory at 5°C. [41°F.] and were kept moist. They remained viable even when moist and kept at −21°C. [−5·8°F.] for 72 hours. The resulting larvae were perfectly healthy. Larvae were injured by keeping the eggs at −25 or −27·2°C. [−13 or −16·96°F.] and lacked the strength to free themselves from the egg. The immature stages occur among emergent vegetation, particularly *Leersia oryzoides*, but are more abundant in light than densely shaded areas. Although the adults are night fliers, they commonly bite in bright sunlight and are attracted to light in large numbers. Eggs are normally laid in water less than a foot deep. During 1941, the water level fell by about a foot in August, the water receded from the breeding places and became heavily overgrown with floating plants, and breeding was inhibited. Control based on fluctuation of water level should be very effective.

Bang (F. B.), Quinby (G. E.) & Simpson (T. W.). **Studies on *Anopheles walkeri* Theobald conducted at Reelfoot Lake, Tennessee, 1935–1941.**—*Amer. J. trop. Med.* **23** no. 2 pp. 247–273, 17 figs., 20 refs. Baltimore, Md., 1943.

The following is based on the authors' summary and conclusions. *Anopheles walkeri*, Theo., is widely distributed throughout eastern North America, but is abundant only in rather restricted areas. Its bionomics were studied during the summers of 1935 to 1941 at Reelfoot Lake, Tennessee, where light-trap collections showed it to form about 38·5 per cent. of the Anopheline population. Larvae were found in thick, shaded emergent vegetation, most frequently among cut-grass (*Zizaniopsis miliacea*) sheltered by willows or button-bushes (*Cephalanthus occidentalis*), but with changing water-levels, they occurred in other situations, such as partly submerged beds of *Polygonum*, *Scutellaria*, *Lycopus* and *Mikania*. Adults were taken in light-traps up to 1½–2 miles from breeding places. They rested by day in dark, moist situations, preferably on the dark, shaded bases of mature cut-grass, but if this was not available, on the button-bushes at the shoreline and in flooded forest. They usually rested a few inches above the water, occasionally above moist mud and very infrequently in drier places. Females engorged with fresh blood were found resting temporarily near the moist floors of barns and occasionally in dwellings. Under experimental conditions, the number of adults penetrating into houses depended greatly upon the illumination and appeared to vary roughly with the intensity of light at the point of entrance, but was not apparently influenced to any great extent by the presence of people in the house. They were found in dwellings much less frequently than those of *A. quadrimaculatus*, Say, and then only in poorly screened houses with some illumination. A single female out of 2,003 of which the salivary glands were dissected in 1939 and 1940 was found infected with an unidentified species of *Plasmodium* [*R.A.E.*, B **28** 122], and three of 1,171 females of *A. quadrimaculatus* examined at the same time were infected. The two species are shown to differ in colour of the halteres, scales of palpi and proboscis and morphology of the salivary glands as well as in the distinguishing characters already recognised. Winter eggs of *A. walkeri* [**25** 183] were laid at Reelfoot Lake during the first fortnight of September in 1937 and between 16th and 23rd September in 1939. The adults were more susceptible to heat than those of *A. quadrimaculatus*, but both had increased resistance when fed on sugar solution or blood. Light-trap collections showed that large numbers of *A. walkeri* were in flight only at temperatures above 75°F., with one unaccountable exception.

The possible importance of *A. walkeri* as a vector of malaria is discussed. It occurs in the south-eastern part of the United States where the disease is endemic and also in northern areas where brief, devastating epidemics may still occur. Although its breeding places are restricted, it multiplies freely where favourable ones exist. The females disperse two miles, bite fiercely even in bright daylight, feed on man and domestic animals with equal avidity [**31** 169], and are experimental vectors [**21** 148; **25** 27]. They are phototropic and may enter houses more readily as electric light is installed in rural areas. On the other hand, they frequently bite the more available domestic animals, they do not enter dwellings so readily as adults of *A. quadrimaculatus*, and they are delicate. In endemic areas where both species are found, *A. quadrimaculatus* appears to be the important vector, and malaria is not known to exist where *A. walkeri* is the only Anopheline. However, an exceptionally favourable environment and ample opportunity for contact with man exist at Reelfoot Lake, and where similar conditions have developed in regions formerly free from malaria, the introduction of the parasite might show *A. walkeri* to be a vector of importance.

WILKINSON (H.). **The 1942 Anti Mosquito Campaign in Bermuda.**—*Mosq. News* **3** no. 1 pp. 6–9. New Brunswick, N.J., 1943.

A severe epidemic of dengue with 1,401 recorded cases occurred in Bermuda in the autumn of 1941. A campaign for the control of mosquitos was therefore carried out for six months in 1942. All mosquitos were included owing to the difficulty of distinguishing the vector, *Aëdes aegypti*, L., from others. Tanks were screened or supplied with fish, abandoned tanks were punctured, rock cisterns filled or punctured, gutters straightened, needless receptacles and rubbish cleared, water-containing plants uprooted and much undergrowth cut away. As a result of these operations, a trap that had taken 74 mosquitos during three nights in May caught only five over the same period in October, and catches in other traps were similar. The work was later extended to include the islands in the Great Sound, Hamilton Harbour and St. George's Harbour and the boats moored in those waters. Measures for the control of marsh-breeding mosquitos included the digging or clearing of over eight miles of trenches. The total numbers of mosquitos trapped were 260 of *A. aegypti*, 220 of *Culex fatigans*, Wied., 73 of *A. sollicitans*, Wlk., and 249 of *A. taeniorhynchus*, Wied. A continuation of the work in 1943 was planned, and it was hoped that by midsummer, mosquitos would be sufficiently reduced in numbers to be under permanent control.

KNIPLING (E. F.), GJULLIN (C. M.) & YATES (W. W.). **A New Oil-emulsion Mosquito Larvicide.**—*Mosq. News* **3** no. 1 pp. 14–16. New Brunswick, N.J., 1943.

The use of an emulsion of diesel oil or fuel oil no. 2 containing 4 per cent. of a sulphated sperm oil (Nopco 1216), a phthalic glyceryl alkyd resin (B –1956) or an 18-carbon-chain complex amine (Amine 230X) as an emulsifier made it possible to reduce the amount of oil required to control mosquito larvae to about 6 U.S. gals. per acre. The mixture of oil and emulsifier was diluted for application with 5 6 parts water (or 7 parts when Amine 230X was the wetting agent). Results were more satisfactory in fresh than in salt water. An application of 40 U.S. gals. of the diluted emulsion per acre against flood-water mosquitos in the Pacific Northwest was as effective as the same quantity of oil, which cost three times as much. The results reported are based on the particular samples of the emulsifiers received and assurance cannot be given that there will not be considerable variation between lots. The 23 other emulsifiers tested were not effective.

Mapes (G. W.). **A Method of abating Salt Marsh Mosquitoes.**—*Mosq. News* **3** no. 1 pp. 23–30, 1 ref. New Brunswick, N.J., 1943.

Control of salt-marsh mosquitos has been effected in Solano County, California, by flooding large areas of marsh during breeding or hatching and draining off the water when the pupal stage has been reached. A modification of this method was adopted in part of Santa Clara County in and after 1934. A diked region is flooded to a level that makes it possible for oil to be distributed over the entire area from a boat. The level is maintained during the oiling period and for a very short time after it. By this method, an area within dikes having adequate gates can be oiled practically as soon as first-instar larvae hatch. If a sufficient depth of water for a boat cannot be obtained over the entire diked area, it is sometimes possible to raise the level to within about 3 inches of the ground and spray the surface from a power sprayer unit set in a boat. This was done with success in one marsh in the spring of 1942. The equipment used is described and its cost is shown.

Buonomini (G.). **L'esame delle setole antepalmate per lo studio della popolazione larvale dei focolai naturali di** *A. maculipennis*. [The Examination of the antepalmate Hairs in the Study of the larval Population in natural Breeding Places of *A. maculipennis*.]—*Riv. Parassit.* **4** p. 163. 1940. (Abstr. in *Dtsch. tropenmed. Z.* **45** pt. 15 p. 466. Leipzig, 1941.) [Recd. 1944.]

The author has found that fourth-instar larvae of vars. *typicus*, *labranchiae*, Flni., *atroparvus*, van Thiel, *messeae*, Flni., *melanoon*, Hackett, and *sacharovi*, Favr (*elutus*, Edw.) of *Anopheles maculipennis*, Mg., can be distinguished from each other by differences in the average numbers of branches on the antepalmate hairs of the fourth and fifth segments, though there is some difficulty in differentiating *labranchiae* from *atroparvus* and *messeae* from *melanoon*.

Del Vecchio (G.). **Osservazioni sull'***A. algeriensis*. [Observations on *A. algeriensis*.]—*Riv. Parassit.* **4** p. 221. 1940. (Abstr. in *Dtsch. tropenmed. Z.* **45** pt. 15 p. 467. Leipzig, 1941.) [Recd. 1944.]

Morphological characters of the eggs, larvae and adults of *Anopheles algeriensis*, Theo., from the province of Littoria, Italy, are discussed. They differ from previous descriptions, and it is possible that *A. algeriensis* may include a number of varieties.

Corradetti (A.). **Note sull'** *Anopheles garnhami* **d'Abissinia.**—*Riv. Parassit.* **4** p. 141. 1940. (Abstr. in *Dtsch. tropenmed. Z.* **45** pt. 15 p. 467. Leipzig, 1941.) [Recd. 1944.]

The author describes all stages of *Anopheles garnhami*, Edw., from Dessie, Abyssinia, and states that there was marked variation in larvae, pupae and adults, though variation in one stage was independent of that in another. The egg is described for the first time.

Corradetti (A.). **Ricerche sperimentali sulla biologia dell'** *Anopheles pharoensis* **in rapporto al tipo focolaio larvale e alle condizioni di temperatura.** [Experimental Investigations on the Biology of *A. pharoensis* in Relation to the Type of larval Breeding Place and to Temperature.]—*Riv. Parassit.* **4** p. 83. 1940. (Abstr. in *Dtsch. tropenmed. Z.* **45** pt. 15 pp. 467–468. Leipzig, 1941.) [Recd. 1944.]

An account is given of field and laboratory observations [? in Abyssinia] on the ecology of larvae of *Anopheles pharoensis*, Theo., which is somewhat

specialised. The laboratory experiments were made with water and vegetation from various natural breeding places and with pure water. Under these conditions, the optimum temperature for development varied with the composition of the water and the food. Development was quickest (16 days) and mortality least when clear water was used, the average temperature was 21·9°C. [71·42°F.] with an average daily variation of 5·1°C. [9·18°F.] and a proprietary fish-food was provided.

De Jesus (P. I.). **Physiochemical factors affecting the Breeding of** *Anopheles minimus* **in the Philippines.**—*Riv. Parassit.* **4** p. 153. 1940. (Abstr. in *Dtsch. tropenmed. Z.* **45** pt. 15 p. 468. Leipzig, 1941.) [Recd. 1944.]

Anopheles minimus var. *flavirostris*, Ludl., breeds chiefly in the beds of brooks and rivers, preferably in clean water rich in oxygen. The nitrogen and iron contents of the water [*cf. R.A.E.*, B **25** 71, 261] and the temperature and the speed of the current seem of less importance.

Marshall (J. F.). **The Control of Tank-breeding Mosquitoes in the City of Portsmouth.**—[2+]4 pp. Hayling Island, Hants., Brit. Mosq. Contr. Inst., 1943.

It has been considered that all tanks set up to store water for fire-fighting in Britain are likely to become breeding places of many different species of mosquitos, but the author gives reasons for disagreeing with this view [*cf. R.A.E.*, B **30** 160]. Although oil is injurious to the bituminous products used for lining these tanks, experiments carried out by A. W. Attwooll showed that cresol larvicides can safely be used in them. Monthly inspection of tanks in Portsmouth was carried out from 23rd April to 10th November 1942. The only mosquitos observed breeding in them were *Culex pipiens*, L., and *Anopheles maculipennis*, Mg., which occurred in 27 and 7 tanks, respectively, but not together. The first positive record was made on 7th May and the last on 6th October. The type of tank, its capacity and the stages found are shown in a table, together with an indication of the presence or absence of algae and predacious insects. Predacious insects were found in the same tank as mosquito larvae on 11 occasions and in larva-free tanks on 55. The results indicated that the chief factor determining infestation is the size of the tank, breeding becoming more uncommon as capacity increases beyond 10,000 gals. This does not apply, however, in the case of Anophelines breeding in water stored in unlined excavated sumps containing masses of filamentous algae. In no case were infestations large, and the proportion of uninfested to infested tanks was considerable. On each occasion on which breeding was observed, the water was oiled or cleared of algae or both [*cf.* **31** 143], and only in one instance was breeding reported twice during the season from the same tank. Possible reasons for the absence from the tanks of other species of mosquitos that occur in the district are suggested.

Angus (W. R.), Thomas (I.) & Williams (O. G.). **Field Experiments on the Control of Sheep Maggots.**—*Ann. appl. Biol.* **30** no. 2 pp. 164–169, 3 graphs, 5 refs. London, 1943.

These experiments on the control of blowflies were made on about 4,700 sheep on some 40 farms in North Wales in 1941. During the 43 days following crutching, 5·1 per cent. of a flock of lambs were struck, while the percentage struck in an uncrutched flock was 21·8. When tail strikes only were considered,

the advantage of crutching was even more evident. The treated lambs were barely distinguishable from untreated ones a month after crutching. During the 34 days following dipping, 2·8, 14·3 and 21·6 per cent. of the ewes, yearlings and lambs in batches treated with zinc arsenite dip (0·1–0·2 per cent. As_2O_3) were struck, the corresponding figures for those treated with commercial arsenic-sulphur dip (0·2 per cent. As_2O_3) being 5·8, 14·3 and 17. It was observed in experiments in which very detailed records were kept that several of the lambs dipped in zinc arsenite were struck two or more times whereas comparatively few of the lambs dipped in the commercial preparation were struck twice and none more than twice. It is concluded that zinc arsenite has no ovicidal action and that its larvicidal action is not better than, if as good as, that of the commercial dip. Of ewes and lambs dipped in 0·015–0·2 per cent. calomel [mercurous chloride], 4·3 and 9·8 per cent., respectively, had been struck 39 days after dipping, while the corresponding figures for ewes and lambs treated with commercial dip (0·08 or 0·2 per cent. As_2O_3) were 3·2 and 9·9 [*cf. R.A.E.*, B **30** 81]. Calomel has the disadvantages of being colourless, difficult to prepare and maintain in suspension and more costly than commercial arsenic-sulphur dips, and it is not lethal to keds [*Melophagus ovinus*, L.] or ticks. In a series of experiments under varying conditions on the effect of adding calomel to a commercial dip, the percentages of ewes and lambs struck during various stated periods averaged 9 and 20·4 when the commercial dip (0·1 or 0·2 per cent. As_2O_3) was used alone and 17·9 and 9·2 when 0·01–0·1 per cent. calomel was added to it. The poor results with ewes are attributed to the fact that a dip containing a wetting agent was used in all the experiments in which the rate of infestation among them was high. It is thought that the active principle of calomel is probably finely divided mercury or a salt of mercury, which would be less readily retained in the fleece, particularly the short fleece of ewes at dipping time, than the macroscopic particles of the commercial dip. The improvement effected in the results by the addition of calomel did not appear to be related to the concentration used. Strike was most prevalent on lowland flocks, particularly those grazing on pastures or sandy belts near the sea and on overstocked, close-cropped pasture. The viscosity of the dip increased with the number of sheep dipped, and surface tension decreased to a minimum and then increased. The greater the increase in viscosity, the greater was the initial decrease in surface tension.

SAID (M.). **Breeding of *Chrysomyia megacephala* in closed Septic Tanks.**—*Indian med. Gaz.* **78** no. 3 p. 148, 4 figs. Calcutta, 1943.

In the course of studies on the possibility of septic tanks providing a breeding place for *Culex* in India, continuous breeding of *Chrysomyia megacephala*, F., was observed to occur in the fermenting faecal material in an enclosed space. The tanks are masonry structures divided into three compartments, in the first two of which anaerobic digestion takes place under a solid scum 6–9 inches deep. No scum forms in the third compartment, and most of the faecal material has liquefied. As the vents in the cowl on the soil pipe were the only openings through which mosquitos could enter or leave the tank, a trap was fixed over the cowl. Large numbers of *Culex fatigans*, Wied., and *Chrysomyia megacephala* were taken leaving the tank, fresh catches being made every morning for five days. In a search for the immature stages, a pure culture of *Culex fatigans* was obtained from the third compartment, and Muscoid puparia, presumably of *Chrysomyia megacephala*, were found in the dry scum in the other two. As a control measure, the cowl was removed, the top of the pipe covered with mosquito-proof muslin and the cowl replaced. Production of *Culex* stopped within a week, but breeding of *Chrysomyia* continued. Adults were found in the septic tank 18 weeks after the blocking of the means of access.

Ferreira (C.). **Alguns aspectos da tripanosomiase humana no Noroeste da Colónia de Moçambique.** [Some Aspects of Sleeping Sickness in the Northwest of the Colony of Mozambique.]—*Bol. ger. Med.* **24** no. 7–9 pp. 100–109, 1 map, 7 refs. Nova Goa, 1942. [Recd. 1944.]

Glossina morsitans, Westw., occurs in north-western Mozambique, particularly in the areas close to Lake Nyasa, and many cases of sleeping sickness due to *Trypanosoma rhodesiense* have been observed there. Several clinical cases are described, and the fly-infested areas are shown on a map.

de Mesquita (B.). **Considerações sôbre o impaludismo em Angola.** [Malaria in Angola.]—*Bol. ger. Med.* **24** no. 7–9 pp. 111–120 [+1]. Nova Goa, 1942. [Recd. 1944.]

The author gives statistics showing the incidence of malaria in Angola in 1938, 1939 and 1940, with notes on the characters and local distribution of the principal Anophelines. They are *Anopheles gambiae*, Giles, *A. funestus*, Giles, *A. paludis*, Theo., *A. pharoensis*, Theo., *A. pretoriensis*, Theo., *A. obscurus*, Grün., and *A. coustani*, Lav.

Lever (R. J. A. W.). **Entomological Notes.**—*Agric. J. Fiji* **14** no. 2 pp. 40–44, 11 refs. Suva, 1943.

A female of *Amblyomma cyprium*, Neum., was taken on man on a jungle path on Viti Levu at an altitude of about 3,000 ft. Ticks from cattle, pigs and horses in Fiji had been recorded as *A. cyprium* prior to the description of *A. quasicyprium*, Rob. [*R.A.E.*, B **14** 49], but one of them, taken from a cow on Taveuni in 1910, has been found to belong to the latter species. The only other member of the genus in Fiji is *A. acutangulatum*, Neum., recorded from a snake.

Sodium fluosilicate, thinly dusted behind stoves and ice boxes, in cupboards, etc., where there is no exposed food has proved effective for the control of cockroaches. *Periplaneta americana*, L., is the commonest species in houses in Suva, but *Blattella germanica*, L., predominates at a locality further north on Viti Levu. *Supella supellectilium*, Serv., also frequents cupboards and bookshelves in Suva. Two local parasites of the egg capsules of *Periplaneta* are *Evania impressa*, Schlett., and *Tetrastichus hagenowi*, Ratz., which takes 29–40 days to mature within the egg.

As a result of investigations made in March 1943, further notes are given on the breeding places of the common mosquitos of Viti Levu [*cf.* **31** 185].

Lent (H.). **Considerações sôbre a validade do gênero *Eutriatoma* Pinto, 1926 (Hemiptera, Triatomidae).** [On the Validity of the Genus *Eutriatoma*.]—*Rev. brasil. Biol.* **3** no. 2 pp. 237–249, 8 figs., 19 refs. Rio de Janeiro, 1943.

The author briefly reviews recent opinions on the generic classification of Triatomids, and considers that *Paratriatoma* is a valid genus, but that *Eutriatoma* is not even subgenerically distinct from *Triatoma* [*cf. R.A.E.*, B **28** 98]. He quotes a letter from Usinger agreeing with his view that *Mestor* is not distinct from *Panstrongylus* [**29** 156]. He redescribes *T. tibiamaculata*, Pinto, and *T. rubrofasciata*, Deg., the types of *Eutriatoma* and *Triatoma*.

Jiménez-Martínez (P.). **Consideraciones epidemiológicas sobre el foco santandereano de fiebre petequial.** [Epidemiological Considerations on the Focus of Spotted Fever in Santander.]—*Rev. Fac. Med.* **11** no. 4 pp. 183–194, 6 refs. Bogotá, 1942. [Recd. 1944.]

At the end of 1941 and in 1942 an outbreak of spotted fever causing considerable mortality occurred in three municipalities in Santander, Colombia.

Various cases are described, and it is stated that cross immunity tests based on material from one of the municipalities (Zapatoca) showed that this disease, Rocky Mountain spotted fever and Tobia spotted fever [*cf. R.A.E.*, B **26** 41 ; **31** 42] are immunologically identical. The patients observed were either infested by ticks or had a history of tick-bite. The ticks collected from them were *Amblyomma cayennense*, F., and they transmitted the disease to laboratory animals by bite and by injection of crushed material. Cases were most numerous in the summer, and the disease appeared to be related to rural conditions.

Muñoz Rivas (G.). **Algunos datos sobre la araña " coya " en el Tolima.** [Some Data on the " Coya " Spider in the Department of Tolima.]—*Rev. Fac. Med.* **11** no. 4 pp. 208–210, 3 refs. Bogotá, 1942. [Recd. 1944.]

Following reports in the department of Tolima, Colombia, in 1938–39 of serious poisoning associated with the bite of *Latrodectus curacaviensis*, Müller, the author made some experiments with this spider, a brief description of which is given. Suspensions of the cephalothorax and also of the whole spider were injected subcutaneously and intradermally into guineapigs, but without result. Female spiders rubbed on the shaved skin of guineapigs produced transient distress, panting, and a slight paralysis of the hind limbs in one of them. The author concludes that the effects complained of were not due to poison from *L. curacaviensis*.

Martin (H. M.) & Deubler (M. J.). **Acariasis** (*Pneumonyssus* **sp.**) **of the upper Respiratory Tract of the Dog.**—*Vet. Ext. Quart. Univ. Pa* no. 89 pp. 21–26, 1 pl., 9 refs. Philadelphia, Pa., 1943.

Records of infestation of the respiratory tract of seals by species of *Halarachne* and of monkeys by species of *Pneumonyssus* [*cf. R.A.E.*, B **23** 177, etc.] are briefly reviewed. In 1940, Chandler & Ruhe reported an infestation of the upper respiratory tract of a dog in Michigan and described the mite as *P. caninum* [**28** 136]. Accounts are given of three similar infestations found in dogs in Pennsylvania in 1941 and 1942. One of the dogs had died from another cause and one died suddenly without symptoms, but the third was destroyed after having shown extreme nervous reactions for several days. In no case was there much macroscopic change in the sinuses or nasal mucous membrane where the mites were found. All the mature mites examined were pubescent and gravid females. A description of these is given. Specimens from the three cases appeared to be identical in all respects. They do not conform entirely to the description of *P. caninum*, but as they have all the diagnostic features and most of the other structural characteristics of this species, they are considered to belong to it.

Army Louse Powder and other insecticidal Possibilities of Diphenyl Trichloroethane from which it is being manufactured.—*Soap* **19** no. 7 pp. 101, 103, 105. New York, N.Y., 1943.

A powder composed of 10 per cent. diphenyl trichlorethane (2, 2-parachlorophenyl-1,-1,1-trichlorethane) and 90 per cent. pyrophyllite as an inert diluent is being produced for the control of the body louse [*Pediculus humanus*, L.] in the United States army and navy. An Army specification (GNB-A) covering the active ingredient states that it shall contain 48–51 per cent. organically bound chlorine, melt to a clear liquid at 107°C. [224·6°F.], be neutral in reaction and be substantially free from chloral, polymerised chloral, chlorobenzene and

water. Upon ignition, ash shall not exceed 0·5 per cent. It is stated to have been found very effective against numerous other household and farm pests, and an increase in its production to replace some of the materials in short supply for household and stock sprays has been urged. It is reported that mattresses treated with a solution of diphenyl trichlorethane will remain free from further infestation by the bedbug [*Cimex lectularius*, L.] for 60 days.

Papers noticed by Title only.

Rebêlo (A.) & de Carvalho Pereira (M.). **Culicini (Diptera, Nematocera) da Colónia de Moçambique. II** [41 species, some also in previous part, with records of localities].—*Moçambique* no. 34 pp. 81–90, 1 pl. Lourenço Marques, 1943. [*Cf. R.A.E.*, B **30** 112.]

Arnal (A.). **Algo sobre los simbiontes de los mosquitos.** [Notes on the internal Symbionts of Mosquitos.]—*Bol. Soc. esp. Hist. nat.* **41** no. 3–4 pp. 209–213, 1 pl., 1 fig., 10 refs. Madrid, 1943.

Clarke (J. L.). **Do Male Mosquitoes Fly as far as Females? Is the Flight Range of all Mosquitoes the same?**—*Mosq. News* **3** no. 1 pp. 16–21. New Brunswick, N.J., 1943. [See *R.A.E.*, B **31** 199.]

Shannon (R. C.) & Cerqueira (N. L.). *Psorophora lanei*, **um novo mosquito do Brasil e da Bolívia (Diptera, Culicidae).** [*P. lanei*, sp. n., from Brazil and Bolivia.]—*Rev. Ent.* **14** fasc. 1–2 pp. 135–137. Rio de Janeiro, 1943.

Lane (J.). **Sôbre o gênero *Uranotaenia* (Diptera, Culicidae, Culicini).** [The genus *Uranotaenia* in South America, with descriptions of two new species from Brazil.]—*Rev. Ent.* **14** fasc. 1–2 pp. 137–161, 1 map, 24 figs. Rio de Janeiro, 1943.

Pereira Barretto (M.) & Coutinho (J. O.). **Contribuição para o conhecimento dos flebótomos de São Paulo. VIII. Descrição da fêmea de *P. ayrozai* Barretto & Coutinho, 1940 e do macho de *P. basispinosus* n. sp. (Diptera, Psychodidae).** [Descriptions of the Female of *P. ayrozai*, Barretto & Coutinho, and the Male of *P. basispinosus*, sp. n. (taken in a light-trap in São Paulo).]—*Rev. brasil. Biol.* **3** no. 2 pp. 183–189, 9 figs., 23 refs. Rio de Janeiro, 1943.

Simões Barbosa (F. A.). **Descrição de *Culicoides recifensis* n. sp. e do macho de *Culicoides reticulatus* Lutz (Diptera, Chironomidae).** [Description of *C. recifensis*, sp. n., taken biting man and of the male of *C. reticulatus*, both from the City of Recife, Brazil.]—*Rev. brasil. Biol.* **3** no. 2 pp. 261–264, 8 figs., 2 refs. Rio de Janeiro, 1943. (With a Summary in English.)

Stains (G. S.) & Knowlton (G. F.). **A taxonomic and distributional Study of Simuliidae of western United States.**—*Ann. ent. Soc. Amer.* **36** no. 2 pp. 259–280, 133 figs. Columbus, Ohio, 1943.

Wigglesworth (V. B.). **The Fate of Haemoglobin in *Rhodnius prolixus* (Hemiptera) and other blood-sucking Arthropods.**—*Proc. roy. Soc.* (B) **131** no. 865 pp. 313–339, 6 figs., 38 refs. London, 1943.

Philip (C. B.). **Nomenclature of the pathogenic Rickettsiae** [with a check list of the species pathogenic to man and associated with Arthropod vectors].—*Amer. J. Hyg.* **37** no. 3 pp. 301–309, 38 refs. Lancaster, Pa., 1943.

Eyles (D. E.) & Bishop (L. K.). **An Experiment on the Range of Dispersion of** *Anopheles quadrimaculatus*.—*Amer. J. Hyg.* **37** no. 3 pp. 239–245, 1 map, 7 refs. Lancaster, Pa., 1943.

The literature on the range of dispersal of *Anopheles quadrimaculatus*, Say, is reviewed [*R.A.E.*, B **17** 85; **30** 73 etc.], and an account is given of an experiment carried out near Reelfoot Lake, Tennessee, in July 1941. Some 16,500 mosquitos were collected in batches of 400–500 in a lamp chimney with bobbinet over the bottom by suction from a vacuum cleaner. A barn containing 5,000 or more mosquitos could be cleared of 90 per cent. of them in a few hours by this method. Cardboard disks were then placed over both ends of the chimney, and bronzing powder was introduced with an atomiser through a hole in one of them. The advantages of metallic dusts over dyes in solution are shown [*cf.* **25** 193]. After being shaken for a few minutes, the marked mosquitos were transferred to cages from which they were later released. Collections were made in six traps situated at equal intervals in a straight line from 0·25 to 1·5 miles from the point of release and in seven barns 2·0–2·5 miles away in most of which original catches had been made. The method of recapturing mosquitos in the barns was the same as that used in the original collecting. For examination, the mosquitos were chloroformed and placed in white pans under strong light. Very few unmarked mosquitos and no marked ones were recovered in the traps. At one barn 2 miles from the point of release, very large numbers were taken 5–9 days later, including 7, 9, 9, 1 and 3 marked individuals of *A. quadrimaculatus* (representing 0·23, 0·36, 0·53, 0·13 and 0·5 per cent. of the catch for the day, respectively). One of these marked mosquitos was a male. There was no barn nearer to the place of liberation. On the sixth day after release 2 and 1 were taken in barns 2·25 and 2·5 miles away, respectively. This was the only day on which collections were made in these places. No marked mosquitos were taken in the four other barns. Although 3 or 4 mosquitos escaped at the place of marking, it can be concluded that females of *A. quadrimaculatus* can fly 2 and probably 2·5 miles in a relatively short time. The conditions of the experiment are thought to approximate to those that would obtain if all people and livestock were removed to a point two miles from a prolific source of mosquitos.

Hertig (M.). **Notes on Peruvian Sandflies with Descriptions of** *Phlebotomus battistinii*, **n. sp., and** *P. pescei*, **n. sp.**—*Amer. J. Hyg.* **37** no. 3 pp. 246–251, 2 pls., 6 refs. Lancaster, Pa., 1943.

Pesce (H.) & Pardo G. (L.). **Notes on Cutaneous Leishmaniasis and** *Phlebotomus* **in the Province of Andahuaylas, Peru.**—*T.c.* pp. 255–258, 1 map, 3 refs.

In the second of these papers, it is recorded that numerous cases of cutaneous leishmaniasis (known locally as dry uta) and mucocutaneous leishmaniasis (moist uta or espundia) have been observed in the Province of Andahuaylas, Department of Apurimac, Peru, between altitudes of about 3,000 and 8,000 ft. The eight zones in which cutaneous leishmaniasis was found are shown on a map. They include practically the entire populated area of their respective districts. Mucocutaneous leishmaniasis was endemic in only one of them. The region is over 125 miles from the nearest known verruga area, and no evidence was found that verruga exists in it. Sandflies (*Phlebotomus*), the probable vectors of the leishmaniasis, were sought in four of the zones in which only the cutaneous form was endemic and were found in all of them. Batches collected in one zone in September 1939 and May 1940 were sent to Lima for identification and found to consist of two undescribed species. Efforts to rear any of the sandflies were unsuccessful.

The new species are described in the first paper, one as *P. battistinii*, from two females and six males caught in sheds containing cattle or pigs and four females and one male caught in houses, and the other as *P. pescei*, from 17 females caught

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in houses (4 of them biting man), two females on plants near a house and one in a cattle shed. Both species were found in the Pincos Valley at altitudes of 6,500 to 7,800 ft. The internal characters of the head of *P. peruensis*, Shannon, which have not previously been described, are also shown for the female, and the measurements of the wing of *P. noguchii*, Shannon, are given, together with a figure of the wing based on six females and seven males. In a previous note [*R.A.E.*, B **27** 106], the author had concluded that the wing figured for the female by Shannon [**17** 189] was atypical or probably that of *P. verrucarum*, Tns. He had also drawn attention to a marked difference in the size of the eyes of *P. noguchii* and *P. verrucarum*, which is useful for distinguishing living females of the two species with a hand lens. He therefore gives the ratios of the longitudinal diameter of the eye to the distance from the eye to the midline at the top of the head (eye/eye-vertex) for *P. verrucarum*, *P. noguchii*, *P. peruensis*, *P. battistinii* and *P. pescei*; they are 1·11, 0·75, 0·88, 1·05 and 0·90, respectively. He also states that his measurements of the wings of *P. verrucarum*, *P. noguchii* and *P. peruensis* are consistently smaller than Shannon's.

Bang (F. B.) & Glaser (R. W.). **The Persistence of Poliomyelitis Virus in Flies.**—*Amer. J. Hyg.* **37** no. 3 pp. 320–324, 15 refs. Lancaster, Pa., 1943.

The virus of poliomyelitis has recently been isolated from flies caught in nature in the United States [*R.A.E.*, B **31** 17, etc.], but the species concerned were not determined. To obtain information that would be indicative of the probable survival of the virus in flies of various species, experiments were carried out with a strain of human poliomyelitis adapted to mice by C. Armstrong and with the virus of a related disease designated Theiler's mouse "poliomyelitis." The flies used were *Musca domestica*, L., *Muscina stabulans*, Fall., *Sarcophaga haemorrhoidalis*, Fall., *Calliphora erythrocephala*, Mg., and a species of *Lucilia* for which the authors use the name *lepida* [R.-D., possibly *L. illustris*, Mg.]. Descriptions are given of the ways in which they were reared in the laboratory and suspensions for injection into mice were prepared from them. They were exposed to infection by feeding them on infected brain emulsion diluted with distilled water. Five mice were used in each test, and a test was considered positive if one or more mice developed typical flaccid paralysis during the 30 days of observation. In most of the positive tests, all the mice showed these symptoms. Crucial tests were checked by histological examination of mice killed while showing paralysis. Theiler's virus survived for at least 12 days in *Musca domestica* and for shorter periods in each of the other flies, but experiments with the latter were not so complete. It was also recovered from the vomit and faecal spots left by *Musca domestica* and the species of *Lucilia* on the inside of bottles. Mice inoculated with flies infected some days previously developed the disease later than those inoculated with recently infected ones. This suggests that the virus was not multiplying in the flies. Moreover, in three separate experiments on serial passage in flies, the virus was either completely lost by the third passage or present in small amounts only. It was possible to recover the virus from suspensions kept at room temperature for 8 days. Separate inoculation into mice of the abdominal shell and intestine indicated that the virus is not limited to the external parts of the fly. Armstrong's mouse-adapted human strain was recovered only from *M. domestica*, and even in this species it survived only two days. Attempts to recover either virus from adults of *Musca*, *Lucilia* and *Muscina* that had developed from larvae infected by adding brain suspensions to their food were all negative.

Oxer (D. T.) & Ricardo (C. L.). **Notes on the Biology, Toxicity and Breeding of *Ixodes holocyclus* (Neumann).**—*Aust. vet. J.* **18** no. 5 pp. 194–199, 3 refs. Sydney, 1942. [Recd. 1944.]

Certain observations on *Ixodes holocyclus*, Neum., the cause of tick paralysis in man, dogs and other animals in Australia [*R.A.E.*, B **23** 159, etc.], were

made in Victoria in the course of the preparation of antitoxic serum by hyper-immunisation of dogs [*cf.* **30** 28]. As the supply of ticks collected was inadequate, laboratory breeding was adopted. The ticks, which die under dry conditions, were kept in moist sand at room temperature. Guineapigs were very suitable hosts for the larvae, of which a good return was obtained without loss of the animal if not more than 200–300 were applied. Guineapigs were not attractive to the nymphs, however, and only a few survived on dogs, but bandicoots (*Perameles nasuta*) were very attractive and satisfactory hosts, and, if obtained from tick-infested areas, had nearly always acquired immunity. The short-nosed bandicoot, *Isoodon obesula*, which is common in Victoria, was not attractive, but *I. torosus* from Queensland is a natural host and is usually immune in infested areas [*cf.* **31** 204]. While the larvae or nymphs were engorging, the guineapigs or bandicoots were kept in cages with a wire floor, placed in a tray of water over a larger tray containing a solution lethal to ticks. The water in the tray was kept clean, and when some of the larvae or nymphs were fully engorged, they were recovered by straining the contents of the tray. After the nymphs had moulted, the adult ticks were left to harden and pair and were then ready for attachment to dogs. The average length of the life-cycle was about 240 days. Exposure to a temperature of 7°C. [44·6°F.] for a few days was lethal to adults, and engorged females failed to develop and oviposit at 32°C. [89·6°F.]. The longest times for which unfed larvae and nymphs were recorded to have survived were 162 and 275 days, respectively. Both were active at the lapse of these periods. Nymphs attached and engorged satisfactorily after 225 days. The complete life-cycle can occupy 741 days and probably more. The majority of a batch of larvae were active after immersion in water for 36 days, but only two showed signs of life after 42 days. By this time, the water had become rather putrid.

Larvae are toxic, as well as nymphs and adults ; about 500 were required to produce paralysis in a guineapig weighing 500 gm. They also cause great irritation, which persists for several weeks. Experiments are summarised as a result of which it is concluded that 12–24 nymphs are sufficient to cause the death of an adult guineapig. Anti-tick serum is prepared by bleeding dogs that have been hyperimmunised by the application of large numbers of adult, unfed female ticks. It has usually been impossible to keep up the supply of ticks between February and September, and during this period, a rapid drop in antitoxic titre occurs. Details of the immunisation of four puppies are given in a table. It should be possible to immunise dogs satisfactorily in 2–3 months.

Rowe (J. A.). **Preliminary Report on Iowa Mosquitoes.**—*Iowa St. Coll. J. Sci.* **16** no. 2 pp. 211–225, 6 refs. Ames, Iowa, 1942. **Mosquito Light Trap Catches from ten Iowa Cities, 1940.**—*T.c.* no. 4 pp. 487–518, 9 figs. 10 refs. **Bionomics of Iowa Mosquitoes.** (Abstract.)—*Op. cit.* **17** no. 1 pp. 111–113. 1942. [Recd. 1944.]

In the first of these papers, the author gives a list of 35 species of mosquitos taken in Iowa in 1936, 1939 and 1940, showing the localities in which they were found, the breeding places of most of them and the larval associations of some.

In the second he discusses the results of catches in light-traps of the New Jersey type in ten cities in the State in 1940, and of much smaller catches of mosquitos taken biting. The data on seasonal occurrence indicated that periods of increased abundance of mosquitos followed within 10–12 days after periods of increased rainfall. Higher populations occurred after prolonged periods of heavy rains. The mean temperatures were relatively high on nights when the larger catches were made and during periods of increased abundance. The smaller catches were generally made on nights with lower mean temperatures.

The third paper is an abstract of a thesis based on the results of collections in Iowa in 1939 41, in which 39 species of mosquitos were taken, and includes some of the information in the other two. Lists are given of the possible vectors of the mosquito-borne diseases that occur in the State. These include malaria, which increased in incidence in 1939 and 1940 and was transmitted chiefly by *Anopheles quadrimaculatus*, Say, equine encephalomyelitis, which caused losses estimated at over three million dollars in Iowa in 1937–41, fowl pox, and the dog heartworm, *Filaria* (*Dirofilaria*) *immitis*, which, however, appears to occur in Iowa only in dogs that have been brought there from the southern States.

Eddy (G. W.) & Joyce (C. R.). **Ticks collected on the Tama (Iowa) Indian Reservation with Notes on other Species.**—*Iowa St. Coll. J. Sci.* **16** no. 4 pp. 539–543, 12 refs. Ames, Iowa, 1942. [Recd. 1944.]

A list is given of 14 species of ticks that occur in Iowa based chiefly on collections at an Indian reservation and the literature, with notes on their local distribution and hosts. The only two considered important parasites of man are *Dermacentor variabilis*, Say, and *Amblyomma americanum*, L., of which the latter is uncommon in Iowa.

Joyce (C. R.) & Eddy (G. W.). **Host and seasonal Notes on the Rabbit Tick,** *Haemaphysalis leporis-palustris*.—*Iowa St. Coll. J. Sci.* **17** no. 2 pp. 205–212, 1 graph, 17 refs. Ames, Iowa, 1943.

The observations recorded in this paper were made in 1941 in the course of work on ticks in an Indian reservation in Iowa [*cf.* preceding abstract], where *Haemaphysalis leporis-palustris*, Pack., constituted over 20 per cent. of all the ticks caught and was second in abundance to *Dermacentor variabilis*, Say. It transmits tularaemia and Rocky Mountain spotted fever among rabbits, its local host in the area under observation being *Sylvilagus floridanus mearnsi*, but does not readily attach itself to man. *D. variabilis*, which is a vector of both diseases to man, and *H. leporis-palustris* were taken in large numbers from the same rabbits. Ground-feeding birds were found to be common hosts of the immature forms of the latter tick, and a list is given of 29 species from which they were recovered ; by far the greatest number was taken from the brown thrasher (*Toxostoma rufum*). *D. variabilis*, however, was not observed on birds. Other hosts from which larvae of *H. leporis-palustris* were taken, though in very small numbers, were ground hog (*Marmota monax*), cat, dog and opossum (*Didelphis*). The collections showed that the adults of *H. leporis-palustris* occurred on rabbits throughout the spring and summer, but became less numerous in August and disappeared after September [*cf. R.A.E.*, B **31** 130]. The immature forms were most abundant in June–August, but larvae and nymphs were commonly taken up to December. Activity ceased during December, and observations in 1942 showed that it was resumed in March and April.

Fourteen examples of the Encyrtid, *Ixodiphagus texanus*, How., emerged from a single engorged nymph of *H. leporis-palustris* taken from a brown thrasher on 24th April 1941.

Bell (J. F.) & Chalgren (W. S.). **Some Wildlife Diseases in the eastern United States.**—*J. Wildlife Management* **7** no. 3 pp. 270–278, 1 pl., 10 refs. Menasha, Wis., 1943.

Data collected between July 1939 and June 1940 on diseases and parasites of wild animals in the eastern United States are summarised. Observations on cottontail rabbits (*Sylvilagus*) bearing large abscesses from which pure

cultures of staphylococci were consistently isolated strongly suggested that ticks (especially *Ixodes dentatus*, Marx) were involved, probably by providing a means of entry for staphylococci normally on the skin. The condition has been called lymphadenitis. A similar disease of lambs, known as tick pyaemia, is associated with *Ixodes* [*ricinus*, L.] in Britain [*R.A.E.*, B **28** 52]. One rabbit collected in Pennsylvania in August 1941 had a few larvae and nymphs of *Haemaphysalis leporis-palustris*, Pack., and nymphs of *I. dentatus* attached to it, and also more than 50 subcutaneous globules consisting of ticks, in various stages of preservation, enveloped in connective tissue [*cf.* **3** 24]. Those identified comprised adult females, nymphs and larvae of *I. dentatus*. Some of the ticks were completely covered by a mass of fibrous connective tissue and microscopically appeared as faint, dark spots in the centre of translucent nodules, others were covered merely by a thin sheet of tissue and could be distinguished as ticks with the naked eye.

H. leporis-palustris and *I. dentatus* were the only ticks collected from cottontail rabbits ; the former has a wide range over the United States, but the latter is apparently limited to States east of the Appalachian Mountains. Records are given of fleas and mites from cottontail rabbits, fleas, mites and lice from other mammals, chiefly rodents, and fleas and lice from birds. Of the 2,900 fleas of 11 species identified from the rabbits, *Cediopsylla simplex*, Baker, and *Odontopsyllus multispinosus*, Baker, comprised 2,503 and 361, respectively. Some of the fleas and mites were examined for the presence of pathogenic microorganisms, but with negative results. Four rabbits were infested with larvae of *Cuterebra*.

PARKER (R. R.), KOHLS (G. M.) & STEINHAUS (E. A.). **Rocky Mountain Spotted Fever: Spontaneous Infection in the Tick** *Amblyomma americanum*.—*Publ. Hlth Rep.* **58** no. 19 pp. 721–729, 8 refs. Washington, D.C., 1943.

Details are given of the demonstration of infection with Rocky Mountain spotted fever of unfed nymphs of *Amblyomma americanum*, L., collected in Oklahoma near the house of a child who had just recovered from the disease [*R.A.E.*, B **32** 8]. Dogs belonging to the child's family were infested with large numbers of nymphs and some adults of this tick and also carried one adult of *A. maculatum*, Koch, and one of *Dermacentor variabilis*, Say ; nymphs that must have been *A. americanum* had often been found on members of the family. No evidence that Rocky Mountain spotted fever was transmitted by this tick was recorded between 1933 [*cf.* **21** 209, 239] and 1941, but a group of seven cases apparently attributable to it occurred in Oklahoma during August and September of the latter year, and in 1942, there was a group of cases in Texas [**31** 43], the case of the child in Oklahoma and an apparent one in South Carolina where *A. americanum* was the prevailing species. The seven Oklahoma cases of 1941, three of which were fatal, included the whole of one family and the attending physician. All were bitten by ticks at the family's home. Nymphs of *A. americanum* were collected during the outbreak from the dog and cat belonging to the family and from grass and sand near the house. Three were engorged and were tested for infectious agents with negative results, but apparent strains of Rocky Mountain spotted fever were established in guineapigs from the tissues of a pocket gopher trapped on the premises a little later and from nymphs of *A. americanum* attached to it. This is the first record of so many cases in a single household in the same year. Such an occurrence may be explained by the fact that nymphs of *A. americanum* bite man freely, whereas those of *Dermacentor andersoni*, Stiles, and *D. variabilis* do not, and are found in immense concentrations under favourable conditions. *A. americanum* has a wide range of hosts, including rodents and other animals known or presumed to be susceptible to Rocky Mountain spotted fever. This, together with its occurrence on dogs and cats and the fact that

larvae, nymphs and adults all bite man, indicates that it might be a vector of considerable importance. Its distribution is discussed. It is active from spring to autumn, the adults being prevalent early in the season and the immature stages later.

ROBINSON (G. G.). **The Use of a Plaster Substratum for testing Pyrethrum-oil Films against** *Ornithodorus moubata*, **Murray (Acarina: Argasidae).**—*Bull. ent. Res.* **34** pt. 4 pp. 269–277, 4 graphs, 7 refs. London, 1943.

An account is given of tests of the effectiveness of pyrethrum in oil against *Ornithodoros moubata*, Murr. [*cf. R.A.E.*, B **31** 5, 66, 67] when applied in a uniform film on plaster (a mixture of plaster of Paris and kaolin) representing the material that would have to be treated for its control (the mud floor or mud-filling of the walls of African huts). A solution of pyrethrins in refined medium petroleum oil (Pyremist "L") was sprayed on to the plaster, and fully gorged ticks were released on to the sprayed surface 10 minutes later. The dishes were kept at 28° C. [82·4° F.] and 50 per cent. relative humidity. Releasing ticks on to a single series of plaster blocks sprayed previously with increasing doses gave extremely erratic results and was therefore useless for estimating the dosage-mortality relationship. This may have been due to differences in the activity of the ticks. Multiple sprayings were therefore made at various dosages and the mortalities averaged. Averaging about five samples gave fairly consistent results. The susceptibility of third- and fourth-stage nymphs and females to various dosages are shown in tables. The medium lethal doses of Pyremist "L" (0·41 per cent. pyrethrin I) on plaster for the three groups of ticks were about 0·4, 0·6 and 0·8 mg. per sq. cm., respectively. A given amount of pyrethrins was always less toxic when applied in a solution diluted to contain half as much pyrethrin I [*cf.* **31** 67]. Substitution of light for medium oil decreased the toxicity of a given deposit of pyrethrins, but applying the spray as an emulsion consisting of one volume of Pyremist "L" and two volumes of a 1½ per cent. aqueous solution of Lanette wax SX increased it, and also increased the amount of deposit for a given amount of Pyremist. As mortality was thought to be affected by activity and certain phenols have an irritant effect on the tick, a mixture of equal parts of Pyremist "L" and a 10 per cent. solution in oil of the non-toxic 4-chlor-2-methyl-phenol was tried. The mixture was much more toxic than a similar amount of Pyremist "L" diluted with oil to the same pyrethrin content and only slightly less toxic than a similar amount of Pyremist "L" containing twice as much pyrethrin I.

LEWIS (D. J.). **The Culicine Mosquitos of Eritrea.**—*Bull. ent. Res.* **34** pt. 4 pp. 279–285, 1 map, 8 refs. London, 1943.

Records are given of some 30 species of Culicines found in Eritrea between 31st March and 15th May 1942 (dry season), and the faunal areas to which they belong are shown. Eritrea is of particular importance in relation to the possible spread of yellow fever from Africa to the East, as it adjoins the Anglo-Egyptian Sudan, in parts of which the disease is endemic. The mosquitos include *Aëdes aegypti*, L., and its variety *queenslandensis*, Theo., *A. vittatus*, Big., *Culex fatigans*, Wied., *A. simpsoni* var. *lilii*, Theo., and *A. lutcocephalus*, Newst., which are known potential vectors. *C. fatigans* has been found on several occasions in recent years in aircraft arriving in the Sudan from Asmara. The only Culicines seen to bite man in the dry season were *A. aegypti* and var. *queenslandensis*, *A. eritreae*, Lewis, *A. caballus*, Theo., and *C. fatigans*. Engorged females of *C. pipiens*, L., were found in rooms. A list is given of the species commonly found in water containers in or near houses. Control measures

against *A. aegypti* var. *queenslandensis* are carried out at Massawa, and the usual measures directed against the typical form in most towns of the mountain slopes and plains also reduce breeding by *C. fatigans*. Mosquito control is not considered necessary on the high plateau except near aerodromes. *Gambusia affinis holbrooki* has been introduced from the Sudan.

CUNNINGHAM VAN SOMEREN (G. R.). **Notes on the Mosquitos of British Somaliland.**—*Bull. ent. Res.* **34** pt. 4 pp. 323–328, 6 refs. London, 1943.

Records are given of the 22 mosquitos including six species of *Anopheles* found in British Somaliland, based on a brief survey of a limited area in January 1942, supplemented by notes, mostly on larvae, made by D. G. MacInnes between March and June 1942.

Larvae of *A. dthali*, Patt., the only Anopheline previously recorded from British Somaliland, were found in many types of breeding places. They were commonest in the seepages in water courses, footprints, shallow waterholes, rock-pools and brick pits, were once taken in practically pure sea water and once in a large open iron tank, and were numerous both in warm and cold springs. Adults were scarce, and tents did not appear to attract them. Larvae apparently referable to *A. macmahoni*, Evans, were found in a shaded grassy drain from a warm spring, but attempts to rear them failed. Adults and larvae of *A. gambiae*, Giles, both pale in coloration, were found in small numbers. The larvae occurred in foci favoured by *A. dthali* and were taken in warm springs. Larvae of *A. turkhudi*, List., were numerous among *Spirogyra* in seepages in water courses, shallow waterholes, rock-pools and in cold and warm springs. Only one adult was taken, in a crevice in rocks near pools containing larvae and pupae. Adults of *A. pretoriensis*, Theo., were found at Dubar, and larvae were recorded from two other localities by MacInnes. Larvae tentatively identified as *A. rhodesiensis*, Theo., were taken at two places, and MacInnes records the species from a third.

[IVANOVA (L. V.).] **Иванова (Л. В.). Observations on Dispersion and Migration of *Anopheles maculipennis* Females in Villages on the Istra Barrage-lake.** [*In Russian.*]—*Med. Parasitol.* **11** no. 3 pp. 15–20, 3 figs. Moscow, 1942. [Recd. 1944.]

During the summer of 1940, over 18,000 females of *Anopheles maculipennis*, Mg., stained with methyl blue were released in daily batches of about 260 in a village beside a reservoir in the Province of Moscow and batches of 1–2 thousand stained with different colours were released at irregular intervals from the middle of the reservoir. Mosquitos were then trapped in 13 villages, situated at distances up to about 4 miles from the point of release, and the results are given in graphs showing the average numbers recovered at each point and the percentages of the total catches that these represented. For the females released daily, the percentages varied inversely with the distance from the point of liberation, the bulk of them settling within about 2 miles in villages in which there were large numbers of cattle. The distribution of the females that were released at irregular intervals was affected by the weather, especially by the velocity and the direction of the wind. It also appeared that the mosquitos move from village to village after release, since individuals from certain batches were first recovered only from villages on one side of the point of liberation and later only from those on the other, and this is thought to have been due to changes in the direction of the wind.

Mosquitos that penetrated far were in various stages of blood digestion. Those that were released at irregular intervals continued to be recovered for

15–20 days (or even 36 in the case of one batch), but the numbers caught 1–5, 5–10 and 10–15 days after release were in the ratio 5 : 3 : 1.

[Skopin (N. G.).] **Скопин (Н. Г.). Materials on the Phenology of *Anopheles* in Kasakhstan.** [*In Russian.*]—*Med. Parasitol.* **11** no. 3 pp. 21–30, 1 graph. Moscow, 1942. [Recd. 1944.]

An account is given of observations made in 1938–40 on the seasonal occurrence of *Anopheles maculipennis*, Mg., and in less detail, of *A. claviger*, Mg. (*bifurcatus*, auct.) in the Republic of Kazakstan, where wide variations in topography and climate occur [*cf. R.A.E.*, B **28** 182, 183]. Hibernating females of *A. maculipennis* (vars. *messeae*, Flni., and *sacharovi*, Favr) began to abandon their winter quarters at mean temperatures that ranged from 0·9°C. [33·62°F.] to 4·2°C. [39·56°F.]. They first appeared at dates that varied from mid-February in the southern desert to 11th April in the north. In the Tian-Shan and Altai mountains, the dates of emergence varied with the position and altitude of the different localities, and examples illustrating this are given. On the whole, the period between the beginning and completion of emergence from hibernation became progressively shorter from south to north, varying with the rate at which the mean temperature rises. It was usually complete at a mean temperature of 8·2–12·38°C. [about 47–54°F.]. Oviposition began at mean temperatures of 4–6°C. [39·2–42·8°F.] in the south, and 9–13°C. [48·2–55·4°F.] in the north.

The temperatures at which the larvae and adults of the first generation were first observed in the various localities are shown in tables. In general, the larvae hatched later and developed more slowly in the north than in the south. Development was completed in periods that ranged from 20–30 days in the southern desert to 35–40 days in the forest-steppe. The adults usually emerged at a mean temperature of 15–17°C. [59–62·6°F.].

The dates on which mosquito production ceased in autumn, estimated from observations on larvae, coincided with mean temperatures ranging from 2·5 to 9·4°C. [36·5–48·92°F.], but the author considers that a temperature of about 3–5°C. [37·4–41°F.] would probably be more accurate.

Since the phenology of *A. maculipennis* in Kazakstan varies so much from one region of the Republic to another, the periods during which control measures should be carried out should vary accordingly. Treatment of breeding places should begin with the appearance of larvae in the third and fourth instars and should be discontinued when the mean temperature falls to 10°C. [50°F.] or less. Approximate dates for various districts are suggested. A comparison of the phenological data with the mean January and July isotherms showed that the difference in date of occurrence of a given phenomenon (such as the beginning of emergence from hibernation, or the appearance of the larvae) is about 5–7 days for each difference of 1°C. [1·8°F.] in the July isotherms.

The seasonal occurrence of *A. claviger* was observed at three points in the Tian-Shan mountains, where it is common. The cessation of breeding in winter depended primarily on the temperature of the water in the springs. At an altitude of just over 4,100 ft., first-instar larvae had disappeared by 20th October in 1939 and second-instar larvae by 20th November, at water temperatures of 6·5–7°C. [43·7–44·6°F.] and 4·5–5°C. [40·1–41°F.], respectively. At a little over 1,700 ft., second-instar larvae did not disappear until the end of December. Larvae of the third and fourth instars overwintered. Pupation occurred in February at 1,700 ft. and from the end of March to mid-April at 4,100 ft. Adult emergence was completed in 10–15 days, but the interval between it and the appearance of the first-generation larvae was 13–15 and nearly 30 days at the two altitudes, respectively. Adults were present until December at the low altitude and mid-September at the high one.

[Lavrenko (E. M.).] **Лавренко (Е. М.). Morphological Differences in the Larvae of *Anopheles maculipennis* Meig. Subspecies.** [*In Russian.*]—*Med. Parasitol.* **11** no. 3 pp. 30–39, 10 figs., 8 refs. Moscow, 1942. [Recd. 1944.]

Examination of prepared specimens of laboratory-bred fourth-instar larvae of *Anopheles maculipennis*, Mg., vars. *typicus*, *messeae*, Flni., and *atroparvus*, van Thiel, in the Ukraine confirmed that they could be distinguished from each other by the number of branches on certain of the hairs on the dorsal surface of the second and the fourth and fifth abdominal segments, and showed that similar divergences occurred also on the third abdominal segment. The data are shown in tables, and hairs 1–5 (as distinguished by Martini in a paper already noticed [*R.A.E.*, B **11** 148]) on each of the first seven abdominal segments of the fourth-instar larva of *A. maculipennis* are described and figured.

[Beklemishev (V. N.).] **Беклемишев (В. Н.). On the comparative Study of the Life Schemes of the blood-sucking Arthropods.** [*In Russian.*]—*Med. Parasitol.* **11** no. 3 pp. 39–44, 13 refs. Moscow, 1942. [Recd. 1944.]

In this paper, which is introductory to the three that follow and is based partly on them, the author points out that the structure and physiology of any species of animal, as well as its interrelation with its environment, and the consequent peculiarities in the composition and movements of its populations are adaptations that enable it to survive. The sum of these adaptations can be regarded as the life-scheme of the species, and the character of the life-scheme depends on the place of the species in the biocoenosis. The life-schemes of *Anopheles maculipennis*, Mg., and other mosquitos are reviewed, and comparative notes are given on those of other blood-sucking Diptera that have been studied in the Russian Union, including *Phlebotomus papatasii*, Scop., Tabanids, and *Stomoxys calcitrans*, L.

[Detinova (T. S.).] **Детинова (Т. С.). Contribution to the Biology of Mosquitos of the Genus *Aëdes*.** [*In Russian.*]—*Med. Parasitol.* **11** no. 3 pp. 44–52. Moscow, 1942. [Recd. 1944.]

A study was made in 1940 of the gonotrophic cycle of various species of *Aëdes* that occur near Moscow and in the Province of Kalinin. The ovaries of newly emerged females were immature, and they remained so in females kept unfed for up to 14 days, but began to develop in those allowed to take a meal of sugar or blood, though a single blood-meal was not sufficient to complete the process. When females that had received a preliminary feed of sugar were given a blood-meal, development of the follicles proceeded concurrently with blood digestion, though some developed more quickly than others, and eggs were laid. If the blood-meal was interrupted, some of the follicles reached maturity, whereas none does so in *Anopheles maculipennis*, Mg., under similar conditions. This is probably related to the fact that *A. maculipennis* attacks large mammals, whereas most of the species of *Aëdes* studied are associated with small agile mammals or birds, on which feeding is no doubt frequently interrupted.

The state of the ovaries in wild females taken at the peak of the flight period and dissected immediately or after a blood-meal showed that they can repeat the gonotrophic cycle, but that as they reach a more advanced physiological age, their ovaries degenerate, which has not previously been recorded for mosquitos. The gradual changes that take place in the ovaries are described. Females with degenerated ovaries did not mature eggs, though they continued to ingest blood. In autumn they constituted a considerable proportion of the population. In the laboratory, most of the females were able to take a blood-meal immediately after they had laid eggs, and some oviposited a second time, but most of them died

before digestion was complete. Contact with a wet surface induced mature females to oviposit, though they did so less readily than *Anopheles maculipennis* [*cf. R.A.E.*, B **25** 142], and eggs were laid on water or wet filter paper.

The structure and functioning of the Malpighian tubes was much the same as in *A. maculipennis*, and considerable changes took place in them during the process of digestion.

The fecundity of three species was estimated by counting the numbers of eggs laid and those that remained in the ovaries after death and by dissecting females that had had a complete or partial blood-meal. The results, which are tabulated, were somewhat inconclusive but indicated that these mosquitos lay fewer eggs at a time than *A. maculipennis*. All the females that were taken in the field at the very beginning of the flight period were fertilised. Pairing probably occurs soon after emergence, since though the two sexes emerge almost simultaneously, no males were found on or among vegetation in summer and they probably live a very short time. No fertilised females were obtained when large numbers of adults were liberated in the insectary or in cages of various kinds.

[Dolmatova (A. V.).] **Долматова (А. В.). The Life Cycle of** *Phlebotomus papatasii* **(Scopoli).** [*In Russian.*]—*Med. Parasitol.* **11** no. 3 pp. 52–70, 8 figs. Moscow, 1942. [Recd. 1944.]

A detailed account is given of laboratory studies in Stalinabad (western Tadzhikistan) from 1st June to 15th September 1940 on the relation between feeding and oviposition in *Phlebotomus papatasii*, Scop., adults of which were common in inhabited tents near the town. The period that elapsed between emergence and the first blood-meal ranged from 5–6 to 24 hours, but lasted up to 36 hours for females that had not been fertilised. Eggs laid by the latter were not viable. Pairing took place in day-time shelters, cages and even test-tubes and at all stages of blood digestion. Females kept without food survived for up to 3 days, and a single blood-meal was sufficient for the maturation and deposition of eggs, irrespective of whether the blood was taken before or after the ovaries had begun to develop. A peritrophic membrane was formed round the ingested blood, as in *Anopheles maculipennis*, Mg. [*cf. R.A.E.*, B **31** 54], and if the sandfly fed while digesting the previous meal, the second lot of blood was encased in a new membrane, so that the first lot was surrounded by both. The seven stages of blood digestion described by Sella for mosquitos were successfully adapted to this sandfly, the chief variation being in the number of segments occupied by blood. In the first stage, blood has not yet been ingested. It occupies 6 segments in the second stage and progressively fewer in the others, until in the last it has all been digested. The process of digestion lasted 62–72 hours at 28·5–30°C. [83·3–86°F.] or 90–100 hours at 22–27·5°C. [71·6–81·5°F.], and was not affected by preceding starvation.

Dissections showed that the functioning of the lubricating glands was closely connected with the maturation of eggs and that it was subject to the general gonotrophic rhythm.

Ovarian development was closely related to blood digestion and resembled that of mosquitos, so that the five stages of development distinguished by Christophers for mosquitos [*cf.* **29** 93] are adopted for sandflies, with modifications, and are described.

A partial feed resulted in the maturation of a few of the eggs, the number of follicles that developed varying with the size of the meal, though there was a minimum below which none developed. Cases of slight deviation from complete gonotrophic association became more frequent at the end of August (when the temperature fell to 11·2°C. [52·16°F.] at night) and in September, though the adults do not survive the winter. The functioning of the Malpighian

tubules was also closely connected with blood digestion, and the numbers and colour changes of the drops discharged by them in the course of the gonotrophic cycle are discussed. It was apparent that in addition to blood, the females drink other fluids, being probably induced to do so by the dryness of the air. If other liquids are not available, they may take a second blood-meal; this was confirmed experimentally and may be the cause of the erroneous belief that *P. papatasii* must take blood repeatedly in order to mature its eggs.

Females oviposited in the laboratory 8–22 hours after they had completed blood digestion, though some died without having oviposited. Many of those taken in the field after digestion was complete began to lay eggs on the second or third day after capture. Oviposition continued for up to two days, and the condition of the ovaries of wild females indicated that this was also the case in the field. It was induced by contact with a suitably damp surface; no eggs were laid on filter paper that was dry or excessively moist.

Observations on females bred in the laboratory or taken in the field indicated that most of them complete only one gonotrophic cycle, but some 19 per cent. of the individuals that had recently ingested blood had fed before and were thus passing through a further cycle. On the assumption that mortality is evenly distributed among females in the successive gonotrophic cycles, it is calculated that of those that complete the first cycle only 15·4, 2·9 and 0·5 per cent. would survive to pass through a second, third and fourth cycle. Of the sandflies that laid eggs in the laboratory, 96·4 per cent. died immediately after oviposition. One of the others survived for a further eight days, and during this period it took blood three times, but died without having oviposited, though all the eggs in its ovaries were mature. The total number of eggs laid varied from 20 to 90, but this low fertility and the short life of the females is offset by the low mortality of the immature stages and of the adults during the first gonotrophic cycle, since they do not have to fly far from their breeding places to find food. The importance of *P. papatasii* as a vector of sandfly fever, although most of the females do not take repeated blood-meals, is attributed to the fact that they can inherit the infection and so transmit it at the first feeding [**26** 241, etc.].

[Kuzina (O. S.).] **Кузина (О. С.). On the gonotrophic Relationships in *Stomoxys calcitrans* L. and *Haematobia stimulans* L.** [*In Russian.*]—*Med. Parasitol.* **11** no. 3 pp. 70–78, 4 figs., 27 refs. Moscow, 1942. [Recd. 1944.]

The process of blood digestion and maturation of eggs in *Stomoxys calcitrans*, L., was studied in Moscow in 1941. The flies were kept in small muslin cages at 24–27°C. [75·2–80·6°F.] and 40–50 per cent. relative humidity, and were periodically allowed to feed on the ears of a rabbit, after which sugar syrup was placed in the cages and horse manure provided for oviposition. Under these conditions, breeding continued throughout the year without interruption or diapause. The flies did not take blood for 3–4 hours after emergence and did not feed readily for the first day. The dissection of young females that had just ingested blood or coloured sugar syrup showed that the blood passed directly into the mid-gut, whereas the free fluid passed directly into the crop. The flies could ingest blood when the crop was full. The process of taking a blood-meal lasted from two minutes at high temperatures to an hour at 10°C. [50°F.], and females ingested up to twice their own weight of blood. Digestion took place in the hind part of the midgut, and lasted 30 hours at 26°C. [78·8°F.]. There was no correlation between this process and the functioning of the Malpighian tubules. A peritrophic membrane was present in the females, whether they had fed or not. It was formed 3–4 hours after emergence, and remained after the blood had all been digested.

Five blood-meals were insufficient for the maturation of the first batch of eggs, but it is thought that six might be adequate. This gonotrophic dissociation may be due to the fact that the blood is used for the development of several follicles in each ovariole at the same time, and not one only, as in insects that exhibit gonotrophic concordance. The five stages of ovarian development described by Christophers for mosquitos [*cf. R.A.E.*, B **29** 93] have recently been adapted for *Musca domestica*, L., and other flies that breed in dung by Derbeneva-Ukhova, who distinguishes eight stages. These are given, and were found, with one exception, due to the early differentiation of the egg cell, to be applicable to *Stomoxys*.

From preliminary investigations in which females were dissected daily from their first appearance in stables (5th July) onwards and their ovaries examined, it is considered possible to distinguish between individuals that have not yet oviposited and those that have done so. A group of yellow bodies was found to remain in the ovarioles, near their junction with the oviduct, after each batch of eggs was deposited, and it is thought that the number of these groups corresponds to the number of egg batches laid. A similar phenomenon has been observed in *M. domestica*.

Limited observations were also made on the adults of *Haematobia stimulans*, Mg. The process of feeding was similar to that in *Stomoxys*, but feeding on free fluid was much commoner. The formation of a peritrophic membrane and the maturation of the eggs were also similar.

[Derbeneva-Ukhova (V. P.).] **Дербенева-Ухова (В. П.). The Fly-maggots as Components of the Dung Biocenoses.** [*In Russian.*]—*Med. Parasitol.* **11** no. 3 pp. 79–86, 1 ref. Moscow, 1942. [Recd. 1944.]

Investigations by the author and others on flies that breed in dung or manure in various parts of the Russian Union have shown that some species are restricted to small lots of dung and are affected by competition and the drying out of the material, while others breed in large manure heaps and others again in both. In all these groups, some species are restricted to manure of a particular animal and others are not. The breeding of flies is therefore affected to some extent by farming conditions, such as the availability of animals and the disposal of the manure. The flies can be divided into three groups according to their oviposition habits. The first and largest group comprises species that deposit all their eggs at one time, mostly in large heaps of manure, the second those that lay their eggs at different times, though all are matured together, and the third, which includes some larviparous species, those that lay their eggs singly as they mature. The larvae of most species of the last two groups are predacious. The flies can also be divided into three groups according to the degree of their association with man. The first comprises those that are associated with domestic or possibly with wild animals. The adults occur mostly in pastures, some actually feeding on dung and others on blood, either facultatively, as does *Musca larvipara*, Schn. & Dzied., which imbibes drops of blood from wounds made by Tabanids [*cf. R.A.E.*, B **31** 125] but feeds on dung at other times, or obligatorily, as does *Haematobia stimulans*, Mg. The second group comprises species that occur in pastures and near human dwellings and enter animal quarters for oviposition. The adults are coprophagous or facultative feeders on blood. The third group consists of flies that occur only near buildings, in which they feed and oviposit. Some of them, such as *Stomoxys calcitrans*, L., feed on the blood of cattle and usually occur in animal quarters, while others, including *Musca domestica*, L., and *Muscina stabulans*, Fall. [*cf.* **31** 223] occur in houses and latrines in direct association with man and are polyphagous.

[Vanskaya (R. A.).] **Ванская (Р. А.). Hibernation of *Musca domestica* L.** [*In Russian.*]—*Med. Parasitol.* **11** no. 3 pp. 87–90. Moscow, 1942. [Recd. 1944.]

Since *Musca domestica*, L., has been recorded as overwintering in the immature stages in comparatively mild climates, but not in Russia, investigations were made in Moscow in 1937–39 to ascertain whether it does so in a colder region. Samples of soil taken in autumn, winter and spring round and under refuse boxes, near sheds in which manure was stored, and from inside refuse dumps were found to contain larvae and pupae of *M. domestica* and other flies; *M. domestica* constituted 90 per cent. of the larvae and pupae near and under refuse boxes and of the pupae (the only stage found) inside the refuse heaps. The ratio of larvae to pupae was 10 : 28 for *M. domestica* and 2 : 1 for the other species. Most of the larvae and pupae were in the upper 8-in. layer of soil, and their frequency decreased with the depth. Some occurred at 12–16 ins. *M. domestica* was not found in soil under the floor of stables, the larvae and pupae there being chiefly those of *Helina* sp.

It is concluded that fly control should be continued throughout the year in this region, irrespective of the flight period of the adults. Manure should be disposed of before the frosts set in, and the soil under refuse boxes and manure sheds should be treated with larvicides in spring and then ploughed.

[Livshitz (I. M.) & Tarumov (S. G.).] **Лившиц (И. М.) и Тарумов (С. Г.). A Case of Mass Breeding of *Phlebotomus papatasii* in Wintertime.** [*In Russian.*]—*Med. Parasitol.* **11** no. 3 pp. 129–130. Moscow, 1942. [Recd. 1944.]

Considerable numbers of sandflies (*Phlebotomus papatasii*, Scop.) occurred during the winters of 1939–40 and 1940–41 in ground-floor flats in a building in the Crimea that had been constructed in 1939 on the site of a refuse dump. The building was in a locality in which sandfly fever is endemic, cases usually being recorded during the flight period of the sandflies in June–September. Two immigrants from the north developed the disease in one of the flats during the first winter, however. Observations in February 1941 showed that the sandflies congregated in the corners and on the walls of the rooms, the temperature in which was 17–18°C. [62·6–64·4°F.], and most of the females contained blood. They could not be found outdoors, where the temperature averaged 7·7°C. [45·86°F.]. They were seen to emerge from cracks in the floor and from doors in the shafts containing central-heating pipes. It is concluded that breeding occurred under the floor in soil that contained abundant food for the larvae, and that rapid development in winter was favoured by the central heating.

[Vaĭnshteĭn (N. B.) & Zeĭdlitz (M. F.).] **Вайнштейн (Н. Б.) и Зейдлиц (М. Ф.). Contribution to the Localisation of Plasmodia at interparoxysmal Times.** [*In Russian.*]—*Med. Parasitol.* **11** no. 3 pp. 130–131. Moscow, 1942. [Recd. 1944.]

In the periods between paroxysms, the peripheral blood of a man infected with malaria may contain too few parasites for them to be detected by examination of a thick film. Experiments were therefore carried out in February and March 1937 in Astrakhan on the possibility of detecting them by xenodiagnosis. For this purpose, hibernating females of *Anopheles maculipennis* var. *messeae*, Fln., taken from a cool damp building were kept for 4–5 days at 20°C. [68°F.] and 90 per cent. humidity, and batches were then allowed to feed on three patients in whose blood parasites had not been found for some days. The mosquitos were then transferred to small muslin cages and kept under similar conditions. Those that had digested the blood-meal were fed on a

concentrated solution of glucose. Of the mosquitos that fed on the three patients, 29, 14 and 9 were dissected, and oöcysts were found in 3, 1 and 1. It is most unlikely that the mosquitos were already infected when used, since 600 others from the same building showed no trace of infection.

[Lomeĭko (E. I.).] **Ломейко (Е. И.).** *Anopheles algeriensis* **Theob. in the Adygei Autonomous Province (N. Caucasus).** [*In Russian.*]—*Med. Parasitol.* **11** no. 3 p. 131. Moscow, 1942. [Recd. 1944.]

Larvae of *Anopheles algeriensis*, Theo., were found in September 1939 in muddy water from a pond fed by a spring in a village in north-western Caucasus. The banks were overgrown with dense tall vegetation, and the surface of the pond was covered with *Lemna trisulca* and *Ceratophyllum demersum*. Other larvae present were those of *A. hyrcanus*, Pall., *A. maculipennis*, Mg., and unidentified Anophelines. The climate of the locality does not differ much from that of the Sulak delta in Daghestan, which was the most northerly point in the Caucasus at which *A. algeriensis* had previously been observed [*R.A.E.*, B **26** 166].

[Kontorovskaya (T. M.) & Shmalenko (D. M.).] **Конторовская (Т. М.) и Шмаленко (Д. М.).** *Anopheles hyrcanus* **Pall. infected with Plasmodia.** [*In Russian.*]—*Med. Parasitol.* **11** no. 3 pp. 132–133. Moscow, 1942. [Recd. 1944.]

Anopheles hyrcanus, Pall., has only once been recorded as naturally infected with malaria parasites in the Russian Union [*R.A.E.*, B **28** 255], but examination of the salivary glands of 443, 734 and 284 females collected in dwellings or among reeds on a tributary of the lower Dnieper, in the Province of Kherson, in July, August and September 1939 showed that 1, 7 and 4 harboured sporozoites.

[Bogoyavlenskiĭ (N. A.) & Prokopovich (K. V.).] **Богоявленский (Н. А.) и Прокопович (К. В.). The Blowfly** *Calliphora erythrocephala* **Mg. at Baku in Winter.** [*In Russian.*]—*Med. Parasitol.* **11** no. 3 pp. 133–134. Moscow, 1942. [Recd. 1944.]

Calliphora erythrocephala, Mg., breeds throughout the year in Baku, and the adults are most abundant in winter, when other flies are scarce. They occur in numbers on walls, poles and tree trunks exposed to the sun. They become torpid at 6°C. [42·8°F.], are inactive and congregate in groups at 8°C. [46·4°F.], but fly about and feed at 9–10°C. [48·2–50°F.]. Oviposition took place at a mean temperature of 10–12°C. [50–53·6°F.] in an unheated store room, and the egg, larval and pupal stages lasted 3, 21 and 12 days, respectively. Observations on the optimum temperature for the larval stage confirmed those of Derbeneva-Ukhova [*R.A.E.*, B **23** 110], when abundant meat food was provided. The upper temperature limit for the larvae was 39–40°C. [102·2–104°F.], but the adults died in 2–3 minutes at 38·5°F. [101·3°F.]. During the three winter months, two generations were produced in the laboratory, at a mean temperature of 18–22°C. [64·4–71·6°F.] and a relative humidity of 43–46 per cent.; the egg, larval and pupal stages lasted 18–48 hours and 8–11 and 9–12 days, respectively. Sugar and meat were the preferred foods of the adults, but bread, fish, milk, cheese, human faeces and the dung of horses and other animals were also visited. Eggs were laid chiefly on meat and fish, especially if decomposing, and it appeared that females were guided to a suitable medium by smell, since they oviposited through holes or cracks in containers of decaying meat or fish. They easily detect the presence of decomposing organic

matter amidst the rubbish and paper in refuse bins, and the larvae, which are very active, readily find suitable food there. They pupate in the refuse bins and in the soil nearby.

Mitscherlich (E.). **Die Uebertragung der Kerato-Conjunctivitis infectiosa des Rindes durch Fliegen und die Tenazität von** *Rickettsia conjunctivae* **in der Aussenwelt.** [The Transmission by Flies of infectious Kerato-conjunctivitis of Cattle and the Persistence of Infectivity in *Rickettsia conjunctivae* after Removal from the Host.]—*Dtsch. tropenmed. Z.* **47** pt. 3 pp. 57–64, 1 fig., 14 refs. Leipzig, 1943.

Rickettsia conjunctivae, which causes a more or less acute conjunctivitis, often accompanied by a keratitis, in stabled and grazing cattle, occurs in various parts of Germany. In 1942, the author and K. Wagener showed that it could be transmitted by placing infected conjunctival secretion in the eyes of healthy calves. In further investigations, adults of *Musca domestica*, L., and *Stomoxys calcitrans*, L., were infected by being placed in contact with the infected conjunctival secretion in normal saline.

Flies of each species transmitted the infection when transferred to the eyes of calves after 8 hours or less, but *Musca* did not do so after 13 days, the only longer period tested. When suspensions of the flies were placed in the eyes of calves, infection was caused after 24 hours but not after two days or more in the case of *Musca* and was not caused in the case of *Stomoxys*. The rickettsia was not transmitted through the egg to the progeny of either species. In further tests, the rickettsia remained infective in normal saline for 24 hours at room temperature, but not for 48 hours. It lost its infectibility in 24 hours if dried on a slide at room temperature. Quarters where infected calves have been kept should thus become non-infective in 24 hours, even if no special measures are taken.

Hallmann (—). **Beitrag zum Pappatacifieber 1941 auf der Balkanhalbinsel.** [A Contribution regarding Sandfly Fever in 1941 in the Balkan Peninsula.] —*Dtsch. tropenmed. Z.* **47** pt. 3 pp. 64–68, 6 graphs. Leipzig, 1943.

An account is given of observations in 1941 on sandfly fever among German troops on the mainland and on islands near Athens. About 20 per cent. of the men required treatment in July and August. *Phlebotomus papatasii*, Scop., was present and found favourable breeding places among ruined buildings and rocks that had been broken up to provide fortifications. The only practicable measures of control were the removal of débris from living quarters and spraying rooms with a proprietary fly-spray.

Pavlov (P.) & Miljowski (K.). **Untersuchungen über die Zeckenlähme in Bulgarien.** [Investigations on Tick Paralysis in "Bulgaria."]—*Dtsch. tierärztl. Wschr.* **50** p. 529. 1942. (Abstr. in *Dtsch. tropenmed. Z.* **47** pt. 4 p. 99. Leipzig, 1943.)

Observations on the tick paralysis caused in sheep, goats and calves by *Haemaphysalis cinnabarina punctata*, C. & F., in the region between Lake Ochrida and the Vardar, in Serbian Macedonia, showed that it developed only if the tick infested the head, and in such cases was caused by the bite of a single female. Mortality among sheep and goats was high at all ages, 45 of 80 affected sheep dying in one instance, but among cattle only calves were affected. Sheep and goats that recovered acquired the disease in a milder form 20–30 days later. Dogs were not affected. Most of the animals recovered 12–24 hours after the ticks had been removed or killed by means of a 5–15 per cent. creolin ointment. Cases of tick paralysis are commonest in this region after long, cold winters. They occur in cattle grazing in districts with shrubs and trees and not in open meadow land, though the tick is common in both habitats.

Hohorst (W.). **Das Vorkommen von zwei seltenen Zecken,** *Dermacentor marginatus* **Sulzer, 1776, und** *Haemaphysalis concinna* **Koch, 1844, im Hessischen Ried.** [The Occurrence of two rare Ticks, *D. reticulatus* and *H. concinna*, in the Boglands of Hesse.]—*Senckenbergiana* **25** pp. 94–99. 1942. (Abstr. in *Dtsch. tropenmed. Z.* **47** pt. 4 p. 99. Leipzig, 1943.)

Adults of *Dermacentor reticulatus*, F., for which *D. marginatus*, Sulz., is considered an earlier name, are common on sheep near Worms, causing the wool to come away in large patches at the sites of infestation. The tick is found in particular areas, especially boggy sedge meadows that are often the only available source of pasture in winter, since they do not become snowbound. Infestation occurs in winter or early spring and disappears in May. The larvae and nymphs probably develop on insectivora and small rodents. The first adults appear in late summer, but do not feed until the following year. *Haemaphysalis concinna*, Koch, and *Ixodes ricinus*, L., also occur in this district.

Hopf (G.). **Die Schnellbehandlung der Skabies.** [Rapid Treatment of Scabies.]—*Med. Welt* **16** p. 752. 1942. (Abstr. in *Dtsch. tropenmed. Z.* **47** pt. 4 pp. 99–100. Leipzig, 1943.)

Moriphen, a German proprietary alcoholic soap solution in which phenol compounds are the active constituents, has been found effective against scabies [*Sarcoptes scabiei*, Deg.] in man. It has great penetrating power but causes no skin irritation. The liquid is thoroughly rubbed in for 5–10 minutes and the patient remains unclothed until it has dried. Only in severe cases is a second application necessary.

Schuppli (R.). **Ueber Erntekrätze und einen neuen Herd in der Schweiz.** [On Harvest Itch and a new Focus in Switzerland.]—*Schweiz. med. Wschr.* **72** p. 568. 1942. (Abstr. in *Dtsch. tropenmed. Z.* **47** pt. 4 p. 100. Leipzig, 1943.)

An unusually severe outbreak of dermatitis due to larvae of *Trombicula autumnalis*, Shaw, occurred near Bâle in 1942, especially among workers in market gardens where dwarf french beans were being picked. It began in mid-July and ceased in September. The larvae feed for not more than 24 hours and then drop off, but the crusts on the skin persist for 10–14 days.

Olin (G.). **The Occurrence and Mode of Transmission of Tularemia in Sweden.**—*Acta path. microbiol. scand.* **19** pp. 220–247. Copenhagen, 1942. (Abstr. in *Dtsch. tropenmed. Z.* **47** pt. 4 p. 102. Leipzig, 1943.)

Tularaemia increased steadily in Sweden up to 1938 [*R.A.E.*, B **27** 95, 138], but only 56, 9 and 10 cases occurred in the next three years. Of 582 cases in seven years, none proved fatal; the disease appeared to be more severe following direct contact with rodents, to which cause, however, only 18 cases were attributed. Infection was demonstrated in *Aëdes cinereus*, Mg. [**27** 138] and in a batch of *Ceratophyllus* (*Megabothris*) *rectangulatus*, Wahlg., from lemmings, but not in *Culicoides fascipennis*, Staeg.

Roubaud (E.), Lépine (P.), Treillard (M.) & Sauter (V.). **Infection expérimentale de Culicides (Aédines) européens avec le virus de l'encéphalomyélite équine américaine, type Venezuela.**—*Bull. Soc. Path. exot.* **34** p. 130. Paris, 1941. (Abstr. in *Dtsch. tropenmed. Z.* **47** pt. 5 p. 128. Leipzig, 1943.)

The ability of European mosquitos to transmit the virus of equine encephalomyelitis was tested in the laboratory in view of the possibility of its accidental introduction. A Venezuelan strain was used and was transmitted to guineapigs by *Aëdes aegypti*, L., *A. albopictus*, Skuse, and *A. geniculatus*, Ol., but not by *Anopheles maculipennis* var. *atroparvus*, van Thiel.

Lépine (P.), Mathis (M.) & Sauter (V.). **Infestation expérimentale de** *Triatoma infestans* **par le virus de l'encéphalomyélite équine américaine, type Venezuela.**—*Bull. Soc. Path. exot.* **34** p. 115. Paris, 1941. (Abstr. in *Dtsch. tropenmed. Z.* **47** pt. 5 p. 128. Leipzig, 1943.)

Injections of crushed examples of *Triatoma infestans*, Klug, that had fed on guineapigs infected with a Venezuelan strain of equine encephalomyelitis transmitted the virus to laboratory animals. The infectivity of such Triatomids remained constant for 11 days after the blood-meal and then became irregular; it disappeared after 17 days. The virus was not transmitted by bite or by the dejecta of the bugs, so that they are unlikely to be vectors in nature.

Packchanian (A.). **Infectivity of the Texas Strain of** *Trypanosoma cruzi* **to Man.**—*Amer. J. trop. Med.* **23** no. 3 pp. 309–314, 1 fig., 18 refs. Baltimore, Md., 1943.

Part of the material obtained by crushing an example of *Triatoma heidemanni*, Neiva, from Texas, on 5th December 1940 contained many active flagellate, crithidial and metacyclic forms of trypanosomes and infected mice and guineapigs inoculated with it. The rest of the material was introduced into the eye of an adult negro, who developed a disease clinically identical with Chagas' disease of South America. *Trypanosoma cruzi* was demonstrated in his blood and cultured from it, and animal inoculation tests and xenodiagnosis (carried out with *Triatoma heidemanni* and *T. gerstaeckeri*, Stål) were positive. This is the first demonstration that *Trypanosoma cruzi* from the United States is infective to man.

Wood (S. F.). **Observations on Vectors of Chagas' Disease in the United States. II. Arizona.**—*Amer. J. trop. Med.* **23** no. 3 pp. 315–320, 8 refs. Baltimore, Md., 1943. (With a Summary in Spanish.)

The faeces of 570 Triatomid bugs collected from the neighbourhood of the Alvarado Mine [*cf. R.A.E.*, B **29** 192] in Arizona in 1939, 1940 and 1941 were examined for trypanosomes, and 10 examples of *Triatoma longipes*, Barber, from houses, 16 of this species and one of *T. rubida*, Uhl., from the neighbourhood of a tent and one of *T. rubida* from the nest of a wood rat (*Neotoma*) were found to be infected with *Trypanosoma cruzi*. The total number of Triatomids that have now been examined from Arizona is 699, of which only these 28 were positive. In addition to being abundant and having a higher percentage of infectiveness than other species, *Triatoma longipes* is more frequently associated with man and, on account of its larger size, may be more easily crushed and has a greater capacity for infective blood. It is, however, much less widely distributed than many other species, and is restricted to rocky, hilly areas. Data are given showing the tolerance of rodents to feeding by Triatomids. Xenodiagnosis of mammals from Arizona gave negative results.

Mazza (S.). **Comprobaciones de** *Triatoma platensis, Eutriatoma oswaldoi, Panstrongylus seai* **y** *Psammolestes coreodes* **en la provincia de Santiago del Estero, todas ellas sin infestación y de** *Eutriatoma sordida* **con infestación por** *S. cruzi.* **Otros datos sobre infestación esquizotripanósica natural silvestre de** *Triatoma infestans.* [Records from the Province of Santiago del Estero of *Triatoma platensis*, *T. oswaldoi*, *Panstrongylus seai* and *Psammolestes coreodes*, all uninfected with *Trypanosoma cruzi*, and of *Triatoma sordida* infected. Further Data on the natural Field Infection of *T. infestans*.]—*Prensa méd. argent.* **30** no. 34 repr. 23 pp. Buenos Aires, 1943.

Triatomids are common in dwellings in Santiago del Estero, Argentina, where the climate is favourable for their development, but the only species recorded

as having been found there naturally infected with *Trypanosoma* (*Schizotrypanum*) *cruzi* is *Triatoma infestans*, Klug, which is the commonest species throughout Argentina. In recent investigations, infections have been found in *T.* (*Eutriatoma*) *sordida*, Stål, taken from refuges such as tree holes, fence posts and huts of clay and straw in the province, and in some instances the bugs were associated with *T. infestans*, and also with predators such as *Spiniger femoralis*, Stål, and *Microtomus lunifer*, Berg, which were not infected. *T. platensis*, Neiva, *T.* (*E.*) *oswaldoi*, Neiva & Pinto, *Panstrongylus seai*, Del Ponte, and *Psammolestes coreodes*, Bergr., were also taken in the province but none was found infected, though all but the last have been in other parts of Argentina. Following the discovery of *T. infestans* in the nests of birds in the Chaco [*R.A.E.*, B **25** 21], this bug has been taken repeatedly in birds' nests, under bark and in other natural refuges in Santiago del Estero. Some of the examples from birds' nests were infected with *Trypanosoma cruzi*.

VAN DER MERWE (J. S.). **Investigations on the Biology and Ecology of** *Mormoniella vitripennis* **Walk. (Pteromalidae, Hym.).**—*J. ent. Soc. sthn Afr.* **6** pp. 48–64, 10 figs., 16 refs. Pretoria, 1943.

Notes are given on the biology of *Mormoniella vitripennis*, Wlk. (*Nasonia brevicornis*, Ashm.) [*cf. R.A.E.*, B **22** 1, 216, 256; **29** 139] based on observations made in the laboratory at Pretoria, and experiments on the influence of humidity and temperature on development and progeny are described. The number of eggs laid in one batch varied from 1 to 77, but was usually 15–30. At 80°F. and a saturation deficiency of 4 mm. mercury, the average and maximum total numbers of eggs laid were 65·9 and 141. Reproduction continued throughout the year under favourable conditions, but larvae subjected to falling temperatures or low humidity often entered a diapause when mature. Diapause could not be broken by exposure to more favourable humidity. Larvae subjected to a high temperature for a short time appeared to enter diapause, but died without pupating. Of the blowflies found on carcasses in South Africa, *Sarcophaga haemorrhoidalis*, Fall., could support the greatest number of parasites, with an average of 51 per pupa. The average number per pupa of *Lucilia sericata*, Mg., was 22·7. Both sexes are strongly attracted to light during the first two days after emergence, but the reaction is less marked in females that have paired. Significantly more eggs were laid in pupae of *L. sericata* kept in the light (but not in direct sunlight) than in others kept in the dark. The female does not oviposit in the first pupa found, but pierces the pupa with the ovipositor, and both sexes imbibe the liquid exuded [*cf.* **5** 157–158; **22** 2]. The preoviposition period varied from a few hours to over a day at 80°F. and is longer at low temperatures. Pupae containing developing parasites were attacked only in the absence of more suitable hosts. *Chrysomyia chloropyga*, Wied., is attacked more frequently than other blowflies in South Africa, as many larvae pupate on top of the soil and in the carcasses.

L. sericata was used as host in the experiments on temperature and humidity. The technique is described. The influence of humidity was studied at 80°F., which had proved a favourable temperature. The optimum saturation deficiency was about 3 mm. The effect of desiccation could be seen at 8 mm., and at 25, most females were dead on the second day. Results with males were similar except that the males lived a much shorter time. The results in experiments on the effect of humidity on oviposition were very variable, but the most favourable zone appeared to be 3–12 mm. saturation deficiency. In dry air, the females laid very few eggs daily and also lived only a short while. Humidity did not affect the length of the developmental period, but did influence the number of parasites that completed their development. The favourable zone was 4–14 mm. saturation deficiency. Mortality was highest in saturated air, when it occurred generally in the mature larval stage. In dry air, mortality was

greatest among eggs, and most of the larvae that survived the first instar gave rise to adults. The relation between these findings and conditions inside the host puparium is discussed. The most favourable saturation deficiency for all vital processes together was 7–8 mm. The influence of temperature was determined at 4 mm. saturation deficiency. The average length of life increased with a fall in temperature from 4·4 days at 100°F. to 19·7 days at 70°F. More eggs were laid at 70°F. than at higher or lower temperatures, but the number per day was greatest at 85°F. The threshold of development was 51°F. Development could be completed between temperatures of rather more than 65°F. and just under 95°F. and occupied 12 days at 80°F. At 90°F., the optimum saturation deficiency was about 17 mm. and most parasites failed to develop at 4 mm.

The cosmopolitan distribution of *M. vitripennis* is due not only to adaptation to various conditions of humidity and temperature, but also to the ecoclimate in which it lives. As the females cannot reach pupae in the soil, most of the larvae develop in the sphere of influence of the carcass, which tends to stabilise temperature and increase humidity, and the puparium also prevents the desiccation of the larvae. The occurrence of the parasite in cold temperate zones where the average summer temperature is 70°F. and the winter temperature extremely low is probably due to the existence of different biological races. It is unlikely that unfavourably high humidity will often occur in the main sheep-rearing districts of South Africa.

De Meillon (B.). **New Records, and new species of Nematocera (Diptera) from the Ethiopian Region.**—*J. ent. Soc. sthn Afr.* **6** pp. 90–113, 6 figs. Pretoria, 1943.

This paper includes descriptions of seven new Ceratopogonids and four new mosquitos, two of the genus *Anopheles*. These are *A.* (*Neomyzomyia*) *radama*, sp. n., from Madagascar and *A. coustani* subsp. *caliginosus*, n., from the Belgian Congo.

Wallace (F. G.). **Flagellate Parasites of Mosquitoes with special Reference to *Crithidia fasciculata* Léger, 1902.**—*J. Parasit.* **29** no. 3 pp. 196-205, 7 figs., 32 refs. Lancaster, Pa., 1943.

The nomenclature of the flagellate parasites of mosquitos is discussed, and a list is given of the various species, which comprise four of *Herpetomonas* and *Crithidia fasciculata*, the latter with several synonyms. There is no proof that they are stages in the development of parasites of birds or mammals. Of 18 individuals of *Culex pipiens*, L., collected from a cave on the bank of the Mississippi in Minnesota in January 1942, two had long slender forms identified as *Herpetomonas culicis* free in the hind and mid gut and six had short flagellates identified as *Crithidia fasciculata*, attached in enormous numbers to the walls of the hind gut. On 19th March, one mosquito among 30 of the same species taken in the same cave was found infected with *Crithidia* and a pure culture was obtained. The species is described. Adults of *Culex pipiens* and *Aëdes aegypti*, L., were easily infected with it by feeding them on cultures, and uninfected males and females of *Culex* both acquired infection from infected females kept in the same cage, probably by ingesting faeces. Transitory infections were produced in larvae by feeding them on cultures, but the organisms did not persist in the adult stage.

Beaver (P. C.). **A Tray for collecting Anopheline Mosquito Larvae.**—*J. Parasit.* **29** no. 3 p. 229, 1 fig. Lancaster, Pa., 1943.

The tray described is used in Georgia to collect larvae of *Anopheles quadrimaculatus*, Say, which cannot be taken successfully in a dipper when they occur

among heavy, emergent vegetation and floating débris. It is about 16 ins. long, 9 ins. wide and $\frac{1}{2}$ in. deep. The bottom is made of slats, triangular in cross section, $\frac{3}{4}$ in. wide and set $\frac{1}{8}$–$\frac{3}{16}$ in. apart with a flat side uppermost. It is enamelled white. Vegetation and débris are pressed below the surface of the water with the tray. The larvae pass between the slats and are collected with a pipette.

Jones jr. (J. W.). **Observations and Suggestions concerning some Factors related to Malaria Mosquito Surveys.**—*J. Tenn. Acad. Sci.* **18** no. 4 pp. 298–304, 1 graph, 2 refs. Nashville, Tenn., 1943.

It is the practice in the Mississippi valley to estimate the rate of production of *Anopheles quadrimaculatus*, Say, from breeding places and the consequent need for measures against the larvae from the numbers of adults found in neighbouring buildings that provide shelter for them during the day. The author has found, however, that some of the " collecting stations " chosen do not provide comparable data because they are inspected without regard to physical variables. This is particularly true of buildings with metal roofs, as they provide shelter early in the morning but become so hot and dry as the day advances that the mosquitos are forced to leave them. He has also found that the mosquitos may remain in a particularly favourable shelter for so long a time that their abundance may not indicate very recent production from a breeding place. In one instance a swamp was treated when the number of mosquitos in a neighbouring collecting station rose to 3,000. Dipping records indicated that the treatment had reduced the numbers of larvae by 92 per cent., but it was continued for a further two weeks as there was no reduction in the numbers of mosquitos in the station. It might have been continued indefinitely had not the resident mosquito population of the station been eliminated by spraying when the daily counts had shown the presence of over 3,000 for 24 consecutive days. The counts after spraying varied from 0 to 46 for 11 days and showed no appreciable rise for several weeks.

Another station in which the mosquito population had been over 300 for over a month contained 482 females of *A. quadrimaculatus* on 5th July. On that day, 428 were caught and stained and 400 of these were returned to the shelter. A sample of 200 mosquitos was caught in it on 23rd July and 124 of them showed the stain, indicating that 62 per cent. of the population had been in it for 18 days. Another stained individual was recovered on 9th August, which showed that a female can survive for at least 35 days in nature. In view of these observations, the author suggests that the proper method to adopt in the use of counting stations is to destroy all mosquitos by spraying after each count is made.

On the basis of observations at a reservoir in Mississippi, the author also draws attention to the effect of water fluctuation on the breeding of *A. quadrimaculatus*. A rise of three inches converts a large area of grassland into a marsh favourable for breeding, but a further rise covers the grass so that this area is subject to wave action, while it produces another favourable marsh at a higher level. A reverse sequence results as the water falls, and, in general, a given area remains favourable for not longer than the time required for the development of a single brood.

Hixson (H.). **Data and Observations on the natural Reduction of *Anopheles* Mosquito Larvae in certain Environments.**—*Florida Ent.* **26** no. 2 pp. 17–24. Gainesville, Fla., 1943.

The studies described were carried out in 1938–39 in a small lake and a shaded permanent pond in Florida, the flora and fauna of which are described. *Anopheles quadrimaculatus*, Say, and *A. crucians*, Wied., were present in both

collections from the pond in May 1939, when the temperature of the water was 25–26°C. [77–78·8°F.] and mosquitos and predators were scarce. The numbers of mosquito larvae in the first, second, third and fourth instars and of pupae were 12, 17, 24, 31 and 8, the differences corresponding to the times required to complete the successive stages. Collections in August, when the temperature of the water was 25–27·5°C. [77–81·5°F.] and Anopheline larvae were numerous, showed a decrease of 81 per cent. between the first and fourth instars. This is attributed to the effectiveness of abundant larvae of Hydrophilid beetles (*Tropisternus* spp.) in the absence of minnows. The biotic potential of the Anophelines was, however, high enough to ensure that a considerable number of mosquitos reached the pupal stage. The fauna in the lake included minnows (*Gambusia affinis* and *Heterandria formosa*) in abundance and larvae of *Tropisternus* and other predators in comparatively small numbers. In December 1938 and January 1939, when the water temperature was 17–18°C. [62·6–64·4°F.], a decrease of only 19 per cent. occurred between the first and fourth instars and many individuals completed development. In the middle of April, when the minnow population had increased considerably and the water temperature was 28–29°C. [82·4–84·2°F.], a decline of at least 40 per cent. between the first and fourth instars was indicated, but the pupal incidence showed that a considerable number of mosquitos could still complete development. By May, when the minnow population had reached its height and water temperature was 24–34°C. [75·2–93·2°F.], there was a reduction of about 87 per cent. during larval development and the numbers reaching the adult stage were insignificant. From the middle of June to the end of August, very few Anopheline larvae were found, probably on account of the high water temperatures, which ranged up to 38°C. [100·4°F.].

This study indicates that *G. affinis* is a dominating species. Its effectiveness increased with the size of the mosquito larvae, but depended, in the presence of protective vegetation, on the activity of other aquatic life. The efficiency of *Tropisternus* is not affected by the size of its prey and depends on the Anophelines' habit of remaining immobile in contact with vegetation or other floating matter.

Glasgow (R. D.) & Blair (R.). **Developments in Mosquito Control. The Application of Insecticide Dusts by Explosives should be useful also in Mosquito and Malaria Control Work.**—*Mosq. News* **3** no. 2 pp. 61–66, 3 figs. New Brunswick, N.J., 1943.

A brief account is given of preliminary experiments on the discharge of insecticidal dusts from small mortars by means of a propellent explosive. The method was proposed for use against forest pests, and it appeared that adequate coverage of trees would be obtained from batteries of mortars of suitable size. Its possible application to the control of mosquito larvae, particularly those that occur in epiphytes and swamps difficult of access, is discussed.

Stein (C. D.), Lotze (J. C.) & Mott (L. O.). **Evidence of Transmission of inapparent (subclinical) Form of Equine Infectious Anemia by Mosquitoes (*Psorophora columbiae*), and by Injection of the Virus in extremely high Dilution.**—*J. Amer. vet. med. Ass.* **102** no. 792 pp. 163–169, 4 figs., 2 refs. Chicago, Ill., 1943.

The experiments dealt with include one on the mechanical transmission of a virulent strain of infectious anaemia [swamp fever] of horses from Wyoming by females of *Psorophora confinnis*, Lynch (*columbiae*, D. & K.) reared from larvae collected in Maryland. The materials and methods used are described, and the results are compared with those obtained with other Diptera [*R.A.E.*, B **31** 102]. A horse exposed to the bites of 186 mosquitos that had partly engorged immediately before on one that had the disease in an acute form showed

no clinical symptoms during the next 86 days, but at the end of this period was found to have developed immunity. A horse that received 100 cc. of whole blood collected from it before it was exposed to known virus for the immunity test showed no clinical reactions for 123 days, but inoculation of 250 cc. of its blood into a third horse produced an acute case. A similar inapparent infection was produced in another horse by subcutaneous inoculation of highly diluted virus. This is thought to be the first occasion on which a subclinical carrier form of infectious anaemia has been produced in susceptible animals by the introduction of extremely small amounts of the virus beneath the surface of the skin by the bites of insects or otherwise. The findings suggest that the type and course of other virus diseases may be modified by the amount of infective material received.

SHAUGHNESSY (H. J.) & MILZER (A.). **Experimental Infection of *Dermacentor andersoni* Stiles with the Virus of Lymphocytic Choriomeningitis.**—*Amer. J. publ. Hlth* **29** no. 10 pp. 1103–1108, 1 fig., 10 refs. Albany, N.Y., 1939. [Recd. 1944.]

The literature on the transmission of lymphocytic choriomeningitis is briefly reviewed, and an account is given of experiments on the ability of *Dermacentor andersoni*, Stiles, to act as a vector. Larvae, nymphs and adults of both sexes acquired the virus by feeding on infected guineapigs. It was demonstrated by injection that infection persisted for at least 13 days in the adults, and also that it passed from larvae to nymphs, from nymphs to adults, and from adults to the eggs and larvae of the next generation. Ticks that had engorged in their previous stage on an infected animal were apparently not infectious until they had engorged on a normal one. Attempts to transmit the infection by causing adults that had fed on infected guineapigs in either the nymphal or adult stage to feed on normal ones were uniformly negative, but the virus was transmitted by nymphs that had engorged in the larval stage on an infected guineapig provided that a sufficiently large number was used. It was also transmitted by placing infected crushed ticks or faeces from ticks that had engorged upon infected animals in the previous stage on the lightly scarified skin of guineapigs.

MILZER (A.). **Studies on the Transmission of Lymphocytic Choriomeningitis Virus by Arthropods.**—*J. infect. Dis.* **70** no. 2 pp. 152–172, 3 figs., 33 refs. Chicago, Ill., 1942. [Recd. 1944.]

Previous experiments on the transmission of lymphocytic choriomeningitis are reviewed; the method of transmission in nature is unknown. Spontaneous infection has been demonstrated in man, mice, dogs and rhesus monkeys (*Macaca mulatta*), and infected mice have been found in houses where cases in man have occurred. The disease is sporadic in man with no secondary cases, and there is much to suggest that it may have an Arthropod vector, apart from its experimental transmission by mosquitos [*R.A.E.*, B **27** 231] and ticks [see preceding abstract], and the accidental infection of the author, apparently from the rhesus monkey louse, *Pedicinus* (*Eupedicinus*) *longiceps*, Piag. [**31** 173]. C. Armstrong succeeded in two of several experiments in transmitting the infection by transferring some 100 lice from an infected monkey to a normal one.

The methods and materials used in the author's studies are described in detail. The following is based on his summary. *Aëdes aegypti*, L., effected transmission by biting when incubated at constant temperatures ranging from 26 to 34°C. [78·8 to 93·2°F.], but no virus was detected in mosquitos incubated at or below 25°C. [77°F.] or at 37°C. [98·6°F.]. The best results were obtained with mosquitos kept at 28, 30 and 32°C. [82·4, 86 and 89·6°F.]. Transmission occurred 7–38 days after the infective meal. Three attempts to transmit the

disease from infected to normal guineapigs by the bites of *Culex pipiens*, L., and three by the bites of *A. albopictus*, Skuse, both incubated at 22–25°C. [71·6–77°F.] for 5–15 days after the infective meal, were unsuccessful.

Cimex lectularius, L., incubated at 22–25°C., transmitted the disease from infected to normal guineapigs in 11 out of 18 attempts at intervals ranging from 10 minutes to 85 days. In one instance, the bugs transmitted it from an infected mouse to a normal guineapig after 16 days. Positive results were obtained with adults of both sexes and first-instar larvae. There was evidence that *C. lectularius* is unable to transmit by bite alone, and that transmission usually occurs only when it is allowed to defaecate on the bitten area. The virus was detected in dried faeces collected from bugs as much as 85 days after infection, and was transmitted by rubbing infected bug faeces on the lightly scarified skin of normal guineapigs. One experiment proved that it may persist through moulting from the first larval instar to the second, but it was not detected when the same batch of bugs moulted to the third and fourth larval instars. Its transmission from females through the eggs to the larvae of the next generation was demonstrated in one instance, but two attempts to repeat this experiment were unsuccessful. Attempts to transmit it by forcing mice and guineapigs to swallow living, infected bugs in gelatin capsules failed. One successful transmission experiment was carried out under conditions which approximated to those occurring in nature.

An attempt to transmit the virus from an infected to a normal rhesus monkey by uncontrolled feeding of *Pedicinus longiceps* failed; but it was shown to survive for at least 24 hours in this louse at 22–25°C. Four attempts to transmit it by uncontrolled feeding of infected mites (*Atricholaelaps glasgowi*, Ewing) incubated at 22–25°C. on normal mice at intervals ranging from a few minutes to 25 days gave negative results, but it survived for at least 25 days in infected mites and was transmitted by forcing mice and guineapigs to swallow living infected mites in gelatin capsules.

DAVIS (G. E.). **Relapsing Fever : the Tick *Ornithodoros turicata* as a spirochetal Reservoir.**—*Publ. Hlth Rep.* **58** no. 22 pp. 839–842, 2 refs. Washington, D.C., 1943.

A female of *Ornithodoros turicata*, Dugès, that had developed from a nymph taken in 1936 in Kansas and found to be harbouring relapsing-fever spirochaetes [*R.A.E.*, B **25** 126] was the source of the ticks used to study transovarian transmission of the infection. Of the progeny resulting from the first oviposition of this female and of at least one of four successive generations reared from it, 35, 96, 100, 47 and 100 per cent., respectively, were found to be infective. These results are discussed, and it is concluded that the tick may be a more efficient reservoir of infection than the rodent host. As transmission during pairing has not been demonstrated [**30** 13], it appears that the males have no part in the maintenance of the spirochaete in the tick host.

COWAN (I. McT.). **Notes on the Life History and Morphology of *Cephenemyia jellisoni* Townsend and *Lipoptena depressa* Say, two Dipterous Parasites of the Columbian Black-tailed Deer (*Odocoileus hemionus columbianus* (Richardson)).**—*Canad. J. Res.* (D) **21** no. 6 pp. 171–187, 9 figs., 7 refs. Ottawa, 1943.

The following is the author's abstract. Material derived from deer taken on southern Vancouver Island, B.C., represents all larval stages of the nostril fly, *Cephenemyia jellisoni*, Townsend. Description is given of the external morphology of the three larval stages and the puparium of this fly. The tracheary system of the first instar, and the cephalopharyngeal apparatus of all three are described and figured.

In November and December first instar larvae were found in the nasopharynx of the host where they remained until after the moult. Until they reach maturity second and third instar larvae occupy the retropharyngeal recesses of the deer. They leave the host by way of the nostrils and pupate in the ground.

Observations on the life history and behaviour of *Lipoptena depressa*, Say, both on and off the host, are given. It is postulated that the life span on the host varies from 8 to 13 months and that during this period from four to seven larvae are produced. Larvae do not pupate on the host but fall to the ground as soon as they are liberated. Infestations on a single host may consist of more than 2,000 flies; under such circumstances the deer evinces discomfort. As yet this fly is not known to be involved in the life cycle of any internal parasite of the deer.

Papers noticed by Title only.

Cooley (R. A.). *Ixodes dampfi* **n. sp., nueva garrapata de Mexico (Acarina, Ixodidae).** [*Ixodes dampfi*, sp. n., a new Tick (from *Geomys* sp.) from Mexico.]—*Rev. Soc. mex. Hist. nat.* **4** no. 1–2 pp. 21–24, 1 fig. Mexico, D.F., 1943. (With a Summary in English.)

Dampf (A.). **La crisálida de** *Eusimulium ochraceum* **(Walker 1860). (Insecta, Diptera.)** [The Pupa of *Simulium ochraceum*, Wlk.]—*Rev. Soc. mex. Hist. nat.* **4** no. 1–2 pp. 33–40, 1 pl., 9 refs. Mexico, D.F., 1943. (With a Summary in English.)

Kumm (H. W.), Bustamante (M. E.) & Herrera (J. R.). **Report concerning certain Anophelines found near the Mexican-Guatemalan Frontier.**—*Amer. J. trop. Med.* **23** no. 3 pp. 373–376, 1 map, 9 refs. Baltimore, Md., 1943. [*Cf. R.A.E.*, B **32** 14.]

McIvor (B. C.) & Cherney (L. S.). **Clinical Use of Flea-antigen in Patients hypersensitive to Flea Bites.**—*Amer. J. trop. Med.* **23** no. 3 pp. 377–379, 2 refs. Baltimore, Md., 1943. [Further successful results: *cf. R.A.E.*, B **30** 4.]

Parr (H. C. M.). **The Culicine Mosquitos of Syria and the Lebanon.**—*Bull. ent. Res.* **34** pt. 4 pp. 245–251. London, 1943.

Weyer (F.). **Bestimmungsschlüssel für die** *Anopheles*-**Weibchen und -Larven in Europa, Nordafrika und Westasien.** [Keys to the Females and Larvae of *Anopheles* in Europe, North Africa and western Asia (and to the eggs of the varieties of *A. maculipennis*, Mg.).]—*Dtsch. tropenmed. Z.* **46** pts. 17–18 pp. 441–452, 461–470, 102 figs., 18 refs. Leipzig, 1942. [Recd. 1944.]

De Gaetani (G. F.). **Sulla miasi intestinali.** [Intestinal Myiasis (a case due to *Calliphora erythrocephala*, Mg.).]—*Riv. Parassit.* **6** p. 13. 1942. (Abstr. in *Dtsch. tropenmed. Z.* **47** pt. 4 pp. 98–99. Leipzig, 1943.)

Ross (E. S.). **New and additional Lower California Mosquito Records (Diptera, Culicidae).**—*Pan-Pacif. Ent.* **19** no. 3 p. 86, 1 ref. San Francisco, Calif., 1943. [*Cf. R.A.E.*, B **31** 97.]

De Bach (P.). **The Effect of low Storage Temperature on Reproduction in certain parasitic Hymenoptera** [parasites of *Musca domestica*, L.].—*Pan-Pacif. Ent.* **19** no. 3 pp. 112–119, 7 refs. San Francisco, Calif., 1943. [See *R.A.E.*, A **32** 91.]

[Alpatov (V. V.).] Аллатов (В. В.). **The human Louse** [*Pediculus humanus*, L.], **its Development and Survival at different Temperatures** [a review of the literature]. [*In Russian.*]—*Advances mod. Biol.* **15** no. 2 pp. 190–207, 10 graphs, 32 refs. Moscow, 1942. [Recd. 1944.]

Cobbett (N. G.) & Smith (C. E.). **The Eradication of Sheep Ticks, *Melophagus ovinus*, by one Dipping in dilute Derris-water or Cube-water Dips.**—*J. Amer. vet. med. Ass.* **103** no. 796 pp. 6–10, 3 figs. Chicago, Ill., 1943.

Tests on dipping in suspensions of cubé or derris for the control of *Melophagus ovinus*, L., were carried out on farm flocks comprising 1,068 sheep in Colorado in June 1941 and July 1942 and on range flocks comprising 8,703 sheep in New Mexico in July 1942. The unshorn lambs were 1–6 months old at the time of dipping and the mature sheep had been shorn 1–6 weeks earlier. The sheep were lightly, and the lambs heavily, infested. The flocks were treated according to ordinary practice after dipping, and no attempt was made to free the premises used by farm flocks from infestation. All dips were freshly prepared, and were made by mixing the derris or cubé powder to a paste with water, adding more water to liquefy the paste and then stirring it into the water in the vat. Each sheep was completely submerged at least twice. The dips were inexpensive and very stable and were unaffected by the presence of extraneous matter in the water or its alkalinity. The farm sheep were treated with 4 oz. derris (5 per cent. rotenone) per 100 U.S. gals. water [*R.A.E.*, B **31** 230] and the range sheep with 2, 4 or 6 oz. cubé powder (5 per cent. rotenone) per 100 U.S. gals. Numerous living adults and pupae of *M. ovinus* were present after 36 hours on the flock treated with the 2-oz. dip, but none was found after 16, 30, 63 or 83 days, though a light reinfestation had appeared after 120 days. Most of the sheep treated with the 4-oz. dips were free of infestation within 24 hours. The last living adults were found 7 days after treatment in Colorado and 60 days after treatment in New Mexico. Sheep dipped in the 6-oz. suspension had very few living adults and only a moderate number of pupae 24 hours later, one living adult on the 15th day and no living adults or pupae thereafter. The experiment was concluded 225 days after dipping. Living adults and viable pupae were readily found on undipped control sheep throughout the tests. Pupae that remained attached to the wool of dipped sheep became dry and brittle within 7–10 days. Such pupae contained desiccated adults, partly emerged dead adults or desiccated flaky material. The dips were harmless to the animals and their fleeces.

Hutson (L. R.). **Miscellaneous Veterinary Research in Antigua, B.W.I. Part 1. Studies on Manson's Eye-worm of Poultry. Part 2. Studies on Canine Filariasis.**—Thesis Univ. Toronto, 32 pp., 7 pls., 24 refs. Barbados [1943].

The first part of this thesis deals with studies on *Oxyspirura mansoni*, the intermediate host of which is *Pycnoscelus surinamensis*, L., carried out in Antigua [*cf. R.A.E.*, B **26** 153], where fowls and turkeys are heavily infested under natural conditions. Ducks, guineafowl and pigeons were infested experimentally, but would not eat the cockroaches unless forced to do so. Data on natural or experimental infestation of other birds are briefly reviewed from the literature. The extent of distribution of the Nematode in the West Indies is not known, but it has been recorded in Jamaica and the author has found it in Barbados and Trinidad.

Of 50 examples of *P. surinamensis* from centres of established infestation, 43 were infested, including all the adults and large and medium-sized nymphs and most of the small nymphs but only about half of the very small ones. A fowl did not become infested after ingesting Nematode larvae in the cystic stage, but larvae appeared in the eyes of fowls that ingested large or small larvae (larvae found free in the body cavity of the cockroach and more or less than 1 cm. long, respectively). In view of the trouble involved in separating eggs of *Oxyspirura* from fowl droppings supplies were procured by dissecting gravid females. These eggs hatched in water mixed with fowl droppings, but not in sterile water. Inspection failed to reveal any natural infestation in *Periplaneta*

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americana, L., which was found in numbers near fowl houses. In experiments described at length in which four groups of this cockroach were fed on fowl droppings containing embryonated ova, droppings containing live larvae, uninfested droppings and food that they normally eat, very little of the droppings was eaten by any of the first three groups, nearly all the cockroaches died and none became infested, while the cockroaches in the fourth group remained normal. A further experiment confirmed that fowl droppings are not suitable as food for *P. americana*, but when hatched larvae of *Oxyspirura* were injected into the abdominal cavity of ten individuals, large larvae were found alive and free in the cavity of six of them 60 days later. These larvae were placed on the tongues of three fowls all of which developed infestations of the eye, and they reached maturity and the females produced embryonated ova.

An experiment on the removal of the nictitating membrane from the fowls as a control measure is described. This is similar to one already noticed [*loc. cit.*] except that cysts were not included. Larvae were found in the right eye of one of the three treated birds for 11 days and in its left eye for five days and in the right eye of another bird for seven days. No larvae were found in the treated birds after the eleventh day, but there were larvae in both eyes of each of the three control birds throughout the period of observations (four weeks). Adult worms placed in both eyes of one of the treated birds were not there on the following morning, and three heavily infested birds from which the membranes were removed were free from larvae the following day. Control measures directed against the Nematode should always be accompanied by vigorous measures against the intermediate host.

In the second part of the paper, accounts are given of five cases of canine filariasis caused by *Filaria* (*Dirofilaria*) *immitis* and typical of many occurring in dogs in Antigua. Of the mosquitos recognised as vectors of the disease, *Culex fatigans*, Wied., and *Aëdes* (*Stegomyia*) *aegypti*, L., occur in Antigua and are widely distributed there, the former being the more abundant. Both were found at the homes of the owners of three of the dogs discussed and *C. fatigans* at that of the owner of another. Microfilariae similar to those in the peripheral blood of infected dogs were twice found in *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt., collected from the dogs [*cf.* **29** 186]. Similar ones were found in many instances in examples of *Rhipicephalus sanguineus*, Latr., from infested dogs, but all appeared to be dead.

PARROT (L.). **Notes sur les phlébotomes. XL.—Sur** *Phlebotomus* (*Prophlebotomus*) *minutus* **Rondani et sa variété** *parroti* **Adler et Theodor.**—*Arch. Inst. Pasteur Algérie* **21** no. 1 pp. 38–50, 6 figs., 36 refs. Algiers, 1943.

Both sexes of *Phlebotomus minutus*, Rond. [*cf. R.A.E.*, B **31** 245] and *P. minutus* var. *parroti*, Adl. & Thdr., are described. The typical form, of which *P. parroti* var. *sardous*, Bogliolo [**23** 168] is considered a synonym, apparently occurs throughout the European part of the Mediterranean basin from Spain to Crete, and the author has a specimen from the Crimea. It is replaced in North Africa by var. *parroti*, which occurs throughout Algeria, Tunisia and Morocco from the Mediterranean coast to the northern Sahara, in both inhabited and uninhabited places. Very brief notes are given from the literature on the feeding habits of both, the probability that they are vectors of parasites of the gecko, *Tarentola mauritanica*, and the rearing of var. *parroti*. Neither is thought to bite man.

NÁJERA (L.). **Los** *Phlebotomus* **de Getafe y la fiebre de pappataci.** [The Sandflies of Getafe and Sandfly Fever.]—*Bol. Soc. esp. Hist. nat.* **41** no. 5–6 pp. 281–288, 3 figs., 2 refs. Madrid, 1943.

Following an outbreak of a disease thought by the army doctors to be sandfly fever among troops in a military camp at Getafe in the summer of 1942, the

author visited the site and collected 22 sandflies in various huts in about half an hour. He later received 17 more from the same source. The species represented were, in order of decreasing frequency, *Phlebotomus perniciosus*, Newst., *P. minutus*, Rond. (*parroti* var. *italicus*, Adl. & Thdr.) and *P. papatasii*, Scop. He describes and figures the genital armature of the males and the wing and pharyngeal armature of the females of *P. papatasii*; the females taken all contained blood. Records of the alleged occurrence of sandfly fever in Spain are briefly discussed, and it is concluded that though the vector, *P. papatasii*, is present, the evidence for the occurrence of the disease is inconclusive, since transmission experiments have not been carried out.

Snodgrass (R. E.). **The Feeding Apparatus of Biting and Disease-carrying Flies: a Wartime Contribution to Medical Entomology.**—*Smithson. misc. Coll.* **104** no. 1 (Publ. 3732) 51 pp., 18 figs., 38 refs. Washington, D.C., 1943.

Descriptions are given of the mouth-parts and sucking apparatus of mosquitos, *Phlebotomus* (*Flebotomus*), *Culicoides*, *Simulium*, Tabanids, Asilids, Hippoboscids and *Glossina*, and much briefer notes on those of Stomoxydine Muscids, *Symphoromyia*, Chloropids (*Siphunculina* and *Hippelates*), Streblids and Nycteribiids. The medical and veterinary importance of the various groups is briefly reviewed from the literature.

Thompson (W. R.), Ed. **A Catalogue of the Parasites and Predators of Insect Pests. Section 1. Parasite Host Catalogue. Part 1. Parasites of the Arachnida and Coleoptera.**—ix+151 pp. **Part 2. Parasites of the Dermaptera and Diptera.**—v + 99 pp. Imp. 8vo, multigraph. Belleville, Ont., Imp. Parasite Serv., 1943. Price $2 each.

These are two parts of a section of a catalogue of which the main object is to show the Arthropod parasites and predators of any host, the alternative hosts of the parasites and predators, and the geographical distribution of any parasite, predator or host. It is to be published in four sections, *viz.*, parasite host catalogue, parasite catalogue, predator host catalogue and predator catalogue. In the host catalogues, the parasites and predators are grouped under their hosts, assembled under Orders, and the countries from which each has been recorded and the bibliographical references are given. In the other two catalogues, the hosts are to be grouped under their parasites and predators, and the bibliographical references omitted.

Most of the records have been taken from the first 25 volumes of this *Review*, but some obtained from original publications are included.

Hornby (H. E.) & French (M. H.). **Introduction to the Study of Tsetse-fly Repellents in the Field of Veterinary Science.**—*Trans. R. Soc. trop. Med. Hyg.* **37** no. 1 pp. 41–54, 3 refs. London, 1943.

To be practicable for use against tsetses, a repellent must be completely effective for at least 24 hours and non-toxic to mammals and should be easy to apply as a dip or spray and cheap. An account is given of tests of some 150 substances carried out in Tanganyika Territory over a period of more than a year against *Glossina morsitans*, Westw. Notes are given on the technique used; as a result of the experience gained, chemically clean gauze-covered glass jars are recommended for feeding flies. About six flies that have been starved for four days are put in each jar, and the animals should be brought indoors so that the flies are not unsettled by a sudden change of temperature. A substance to be tested was first applied to a small clipped area of skin on a housed sheep, which was exposed to hungry tsetses for six minutes 24 hours later. It was next

tested similarly on a small unclipped area on an ox kept out of doors all day, then applied to the whole surface of an ox or a donkey to test its toxicity, and finally submitted to comprehensive tests. Only a repellent that prevented at least five out of six flies from feeding and caused no irritation on an unclipped animal underwent the subsequent stages of the trial. A list is given of all the substances tested and attention is drawn to any points of interest concerning them. The only one that was good enough to warrant comprehensive tests was pyrethrum, which was tried in various forms both as a powder suspended in soapy water and as extracts. Its active principles were, however, readily destroyed by sunlight. When the animals were kept in the open and exposed to normal sunlight, a thorough application of a freshly prepared emulsion of 2 per cent. pyagra in weak soap solution (0·2 per cent. pyrethrins) prevented feeding on donkeys for 24 hours or more, but it did not do so on Zebu cattle, and no substance stopped hungry flies from probing after 24 hours. Tsetses transmitted *Trypanosoma rhodesiense* experimentally to rats and an ant-bear by probing without actually feeding, but rats are very susceptible to this trypanosome. Laboratory flies probe much sooner and more readily than wild ones, and, as pyrethrum is absorbed through the pulvilli and rapidly causes paralysis or death [*cf. R.A.E.*, B **19** 14], a fly on an animal treated with it would probably not be able to start feeding at all if it did not do so quickly. The effectiveness of a substance that prevents all feeding, but not probing, can be ascertained only by further field tests. A 2 per cent. emulsion of pyagra was lethal to trypanosomes with which it came in contact. Various tests with this material are described, including a practical one on six donkeys passing for five days through country heavily infested with *G. morsitans*. Three were treated each day and were not worried by tsetse, while the three untreated ones were and one of them developed trypanosomiasis.

Akün (R. Ş.). **Ankara ve civarındaki atların otopsilerinde rastlanan *Gastrophilus* sürfelerinden mütevellit mide hastalıklarının çokluğu ve neticeleri (Myiasis ventriculi).** [The Frequency and Results of the Stomach Diseases (Myiasis ventriculi) caused by the Larvae of *Gastrophilus* as shown by Dissections of Horses in Ankara and its Environs.]—*Çalişmalar yüksek Ziraat Enst. Ankara* no. 129, 45 pp., 43 refs. Ankara, 1943. (With a Summary in German.)

Myiasis of the stomach in horses due to infestation by *Gastrophilus* is common in the district of Ankara, and observations in 1934–41 during which 499 carcasses were dissected showed that nearly 54 per cent. of the animals contained larvae of *Gastrophilus* and that over 63 per cent. of these were suffering from myiasis of the stomach. The various species of the genus and their distribution and in some cases bionomics are briefly reviewed from the literature, and the anatomy and histology of the stomach of the horse are described, together with the disturbances that result from infestation. The species found in greatest numbers was *G. intestinalis*, Deg. (*equi*, Clark), but in some cases *G. nasalis*, L., *G. pecorum*, F., and *G. haemorrhoidalis*, L., were also present. Up to 550 larvae were found in a single stomach, and some evidence was obtained that infestation by less than 100 does not lead to functional disturbance.

Beaumont (J. H.). **Agricultural Science on the War Front. Report of the Hawaii Agricultural Experiment Station for the Biennium ending June 30, 1942.**—149 pp., 1 pl., 24 figs., refs. Honolulu, 1943.

In the section of this report dealing with entomological problems (pp. 111–129), F. G. Holdaway records 86 fatal and 64 non-fatal cases of infestation of young calves by blowflies on 16 out of 29 ranches on Kauai in 1940. The species involved were *Chrysomyia megacephala*, F., *C. rufifacies*, Macq., and *Lucilia*

sericata, Mg. Calves were usually attacked during the first week of life, less commonly during the second and only occasionally during the third. Almost any part of the body might be attacked. Infested calves usually lie down and are ignored by the mother. If not found and treated, they die in a few days. Others died because fly-sprays and other irritants were applied to the affected areas and intensified the condition, leading to the development of additional strikes. Satisfactory results were obtained in tests of the di-boric preparation of glycerine and boric acid developed in Australia [*R.A.E.*, B **23** 292] and a benzene-diphenylamine dressing developed in the United States against *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.) [*cf.* **30** 195]. Strikes did not occur in the hot and dry or moderately warm and moist zones, but were predominant in the moderately warm and wet sections, and were most frequent in the autumn and early winter when rainfall was highest.

A section on parasitology problems (pp. 44–51), by J. E. Alicata and A. C. Cuckler, includes a record of *Filaria* (*Stephanofilaria*) *stilesi*, which causes skin lesions in cattle, principally on the abdomen. The embryos were found in the skin and probably develop in a blood-sucking insect, of which the only abundant ones that feed on cattle in Hawaii are *Stomoxys calcitrans*, L., *Lyperosia* (*Haematobia*) *irritans*, L., and mosquitos. *Hypoderma lineatum*, Vill., was found in 26 per cent. of the cattle examined. Some of the infestations were very heavy, and there were large confluent areas of degenerated fat and connective tissue. *Otobius megnini*, Dugès, occurred on 45 per cent. of the cattle. Infestation ranged from a few ticks to as many as 65 in a single ear, and larvae and nymphs at various stages of engorgement were found at all times of the year. Engorged nymphs moulted 7–8 days after removal from cattle. Pairing occurred two days after moulting, the first eggs were deposited five days after emergence, and the egg stage lasted 10–14 days. The daily mean temperature during the observations was 80°F. Two out of several ticks kept in the laboratory lived rather more than 9 months. *O. megnini* was also found in 43 out of 60 sheep examined from Kahoolawe. *Haematopinus eurysternus*, Nitzsch, occurred in the ear of one bovine. A list is given of the Coleoptera that have been found naturally infested with larvae of *Subulura brumpti* [*cf.* **29** 15] in the stage infective to fowls. *Tribolium castaneum*, Hbst., was also infested experimentally.

TURNER (A. W.). **Spontaneous Oxidation of arsenical Cattle-dipping Fluids and its possible Control by Means of Lactose.**—*J. Coun. sci. industr. Res. Aust.* **16** no. 3 pp. 129–134, 1 graph, 16 refs. Melbourne, 1943.

The factors involved in the oxidation of arsenite to arsenate and the reduction of arsenate to arsenite in sodium-arsenite dips and the importance of these changes are discussed from the literature, and an account is given of observations carried out in Queensland in 1935 on the effect of adding lactose to the dip. The capacity of the vat was 2,250 gals. The concentration of arsenic (As_2O_3) had fallen from 8 to 4·5 lb. per 400 gals. on 31st July when observations were begun and to 4·1 lb. 16 days later. On this day, 3 lb. lactose (0·013 per cent.) was added to the dip. The arsenic concentration reached 6·1 lb. on the 22nd day of observations, and a further 3 lb. lactose was added. The arsenic concentration reached 8 lb. on the 30th day, then fell to 7 lb. on the 42nd day, 6 lb. on the 47th and 5·8 lb. on the 49th, when 3 lb. lactose was again added. Response was delayed for six days, then the arsenic concentration rose, reaching 8 lb. by the 57th day. It began to decrease on the 59th, falling to 7, 6 and 5 lb. on the 73rd, 78th and 85th days, respectively. At this point, 6 lb. lactose was added and the arsenic concentration rose to 7·7 lb. by the 89th day and 8 lb. on the 101st. It remained above 7 lb. until the 108th day and above 6 lb. until the 124th day. The practical application of these findings to dipping of cattle in Australia for the control of *Boophilus annulatus microplus*, Can., is discussed.

Pavlovsky (E. N.). **A new Vector of the Tick Relapsing Fever**—*Ornithodorus nereensis* **Pavl. in Turkmenia.**—*C. R. Acad. Sci. URSS* (N.S.) **31** no. 4 pp. 408–410, 1 fig., 6 refs. Moscow, 1941. [Recd. 1944.]

A description is given of the adults of both sexes of *Ornithodoros nereensis*, sp. n., which was found, together with two other species of *Ornithodoros*, in the Karakala region of south-western Turkmenistan in 1931 [*cf. R.A.E.*, B **23** 72]. It occurred among stones, in crevices in the walls of huts, and in shallow burrows inhabited by mammals, reptiles or birds. Relapsing fever appears to be of rare occurrence in this district, and none of the ticks taken in 1931 showed evidence of natural infection with spirochaetes [*loc. cit.*], but examples of *O. nereensis* taken in 1936 transmitted spirochaetes to mice and also to man when used in experiments on the treatment of progressive paralysis by induced relapsing fever.

Pavlovsky (E. N.) & Cheskis (A. F.). **Susceptibility of the Hen to Central Asiatic Tick Relapsing Fever Spirochaete** (*Sp. sogdianum*).—*C. R. Acad. Sci. URSS* (N.S.) **38** no. 1 p. 54, 2 refs. Moscow, 1943. **Susceptibility of the domestic Pig to Central Asiatic Tick Relapsing Fever Spirochaete.**—*T.c.* pp. 55–56, 15 refs.

Accounts are given of experiments in which the blood of guineapigs infected with strains of *Spirochaeta persica* (*sogdiana*) isolated from *Ornithodoros tholozani*, Lab. & Mégn. (*papillipes*, Bir.) in Russian Central Asia was injected into hens and suckling pigs. Neither developed symptoms of the disease or showed spirochaetes in the blood, and subinoculation into guineapigs also gave negative results.

Gruzdeva (N.). **Developmental Cycle of** *Ixodes persulcatus*, **Transmitter of the Tick Encephalitis in the Maritime Province, Far East of the USSR.**—*C. R. Acad. Sci. URSS* (N.S.) **38** no. 1 pp. 51–53. Moscow, 1943.

Observations by various workers in 1940 indicated that *Ixodes persulcatus*, Schulze, has a three-year life-cycle, but did not provide data on the actual duration of development under natural conditions in the Russian Far East or the stages in which hibernation can occur. Investigations were therefore carried out in 1941 in a forest focus of the encephalitis transmitted by this tick in the district of Khabarovsk [*cf. R.A.E.*, B **31** 70]. Starving females and nymphs collected from various wild animals, and larvae that hatched in cages, were allowed to feed on rabbits and were then placed in cages and kept either under natural conditions in the forest or in the laboratory. The results are very briefly summarised in a table. In the forest, the preoviposition periods of engorged females ranged from 4 to 11 days in May–July and eggs laid in this period hatched in 50–66 days. Larvae and nymphs that engorged in July–August required 30–36 and 27–30 days, respectively, to moult to the next stage, and nymphs that engorged in May required 69 days. All stages were shorter in the laboratory at higher temperatures.

An increase in the numbers of the larvae and nymphs observed under natural conditions about the end of May indicated that they had hibernated, since development from one stage to the next would not have been completed during the spring as the temperature was too low. A second peak in larval abundance observed in August was due to the hatching of the eggs laid by females that had fed in April, May and early June, the egg stage thus coinciding with the warmest part of the year, when rain is abundant.

GRUZDEVA (N.). **Length of Survival under Water of various Stages and Species of Ticks, Transmitters of parasitic Encephalitis in the Maritime Province, Far East of the USSR.**—*C. R. Acad. Sci. URSS* (N.S.) **38** no. 2–3 pp. 102–104. Moscow, 1943.

The experiments described were carried out in 1941 in view of the common occurrence of rain and floods in the parts of the Maritime Province of the Russian Far East in which tick-borne encephalitis occurs [*cf. R.A.E.*, B **31** 70]. Adults of *Ixodes persulcatus*, Schulze, and *Haemaphysalis concinna*, Koch, were submerged in a forest stream at the end of June, larvae and nymphs of *I. persulcatus*, *H. japonica*, Nutt. & Warb., and *Dermacentor silvarum*, Olen., were submerged in the stream or in the laboratory in August, September and October, and adults of these three species in the laboratory in October. None of the ticks had fed in the stage in which it was submerged. The numbers of ticks of the various batches dead on successive days are shown in a table ; periods of survival ranged from less than three days to a little over three weeks. It appeared that adults are in general more resistant than larvae and nymphs, and that the latter become more resistant as the temperature falls and they become less active. Those submerged in September survived longer in the stream, in which the maximum water temperature was 9–9·5°C. [48·2–49·1°F.], than in water at a temperature of 16–18°C. [60·8–64·4°F.]. Maximum resistance to submergence was shown under laboratory conditions in October, when the ticks were about to enter hibernation.

When engorged larvae and nymphs of *I. persulcatus* and *D. silvarum* were submerged for periods varying from 2 to 11 days in July or August, the percentage mortality and the period before the next moult of the surviviors both increased with the duration of submergence. Submersion for 2–3 days did not prevent the emergence of Hymenopterous parasites from the nymphs of both species. In similar experiments carried out in 1936 by Shpringgol'tz-Schmidt, ovipositing females of *D. silvarum* succumbed after only a few days' submergence, a considerable number of the eggs were also killed, and the development of those that survived was markedly retarded. In tests by Olenev in 1941, submergence killed some eggs of *I. persulcatus* and retarded embryonic development in the others.

DAVIS (G. E.). **American Q Fever : Experimental Transmission by the Argasid Ticks** *Ornithodoros moubata* **and** *O. hermsi*.—*Publ. Hlth Rep.* **58** no. 26 pp. 984–987, 4 refs. Washington, D.C., 1943.

Adults of *Ornithodoros moubata*, Murr., that had engorged as first-stage nymphs on guineapigs infected with *Rickettsia diaporica*, the causal organism of American Q fever, effected transmission by feeding up to 428 days later and were shown by injection to conserve the infectious agent in their tissues for 670 days. Transmission by feeding was not obtained before the adult stage. Adults of *O. hermsi*, Wheeler, infected as first- or second-stage nymphs, transmitted the infection up to 772 days later by feeding and were shown by injection to harbour it after as long as 979 days. Transmissions were first obtained at the second test feeding. The infection was inherited and transmitted by the progeny of females of *O. moubata* that had been shown to be infective and others that had failed to effect transmission, and it was also passed to the F_2 generation. The progeny of infected females of *O. hermsi* failed to effect transmission by feeding, but one batch of larvae was proved infective by injection. Long periods of fasting did not decrease the virulence of the infecting organism.

Although American Q fever has not been reported from Africa, the facility with which *O. moubata* transmits it suggests that it may be a natural vector. *O. hermsi* is known to occur and transmit relapsing fever in California, Oregon, Idaho, Nevada, Colorado and Washington. Its hosts are chiefly chipmunks

(*Eutamias* spp.), pine squirrels (*Tamiasciurus* spp.) and man. Attempts to obtain transmission of American Q fever by *O. turicata*, Dugès [*R.A.E.*, B **29** 126] and *O. parkeri*, Cooley, failed. The organism remained infective in *O. parkeri* for 852 days after the infecting feed and 379 days after the last feed. In an unpublished experiment with *O. turicata* and an Australian strain of Q fever [*R. burneti*], the author obtained a typical infection with subsequent immunity by the injection of one tick 647 days after the infecting feed.

TAUBER (O. E.), TAUBER (A. H.), JOYCE (C. R.) & BRUCE (W. N.). **Toxicity of some Dinitrophenols to the American Dog Tick,** *Dermacentor variabilis* **(Say).**—*J. Wash. Acad. Sci.* **33** no. 4 pp. 97–105, 1 fig., 17 refs. Menasha, Wis., 1943.

The experiments described on the toxicity of dinitrophenols, particularly 3,5-dinitro-o-cresol (DNC) to *Dermacentor variabilis*, Say, were carried out with a view to controlling the tick in selected areas by dusting vegetation with them. The dust might reach the ticks directly or as their hosts passed through the grass, and might also control other Arthropods. Adult ticks for tests were obtained from the ground in Iowa or from dogs, and the immature stages were bred from them. Adults and nymphs were made to pass over a band of dust (one inch wide for nymphs and two for adults) on towelling, and larvae were dusted from above. After treatment the ticks were confined in vials and examined periodically. All applications against adults and nymphs were at the rate of 65–75 lb. per acre and those against larvae were at 20–25 lb. per acre.

The following summary of the results of these laboratory tests is mainly based on the authors' conclusions. Contact with 12 per cent. DNC in pyrophyllite killed 88 and 45 per cent., respectively, of unfed and engorged adults in 48 hours. Mixtures of 8 per cent. DNC with 320-mesh dusting sulphur and with pyrophyllite gave 77 and 68 per cent. mortality, respectively, of unfed adults and 60 and 36 of engorged adults in 48 hours. Sulphur alone killed 19 per cent. of unfed adults in 24 hours, but had no effect on a batch of engorged ones. Even with sulphur, at least 25 per cent. DNC was necessary to give a kill of over 95 per cent. in 48 hours. Tested with sulphur against unfed adults, 12 per cent. ammonium dinitro-o-cresylate was nearly as toxic as 25 per cent. DNC, and undiluted sodium arsenite was slightly less toxic. Guanidine dinitro-o-cresylate showed little promise. As nymphs became older, mortality among untreated controls and susceptibility to dinitro compounds increased. At least 16 per cent. of DNC in sulphur was necessary to give 95 per cent. kill of 5-day-old nymphs in 48 hours, but 12 per cent. gave the same kill of nymphs 2–3 weeks old in 24 hours and 16 per cent. gave complete kill in less time than this, while 12 per cent. ammonium dinitro-o-cresylate in sulphur gave complete mortality of 3-weeks-old nymphs in 3½ hours. Control and treated larvae increased in vigour with age. Two per cent. DNC in pyrophyllite gave complete kill of 5-day-old larvae in 20 minutes and of 2-weeks-old larvae in 24 hours, but among larvae 3 weeks old, it killed only 77 per cent. in 48 hours. When the larvae were 4 weeks old, 8 per cent. DNC in pyrophyllite gave complete kill in 2½ hours and the same percentage in sulphur gave complete kill in 24 hours but not in 6. Tested against larvae 4 weeks old, dinitro-o-secondary butylphenol and dinitro-o-cyclohexylphenol appeared nearly as toxic as DNC, but the dicyclohexylamine salt of dinitro-o-cyclohexylphenol, dinitroso-resorcinol and the tetra-, penta-, and hexa-chlorphenols were much less toxic.

Dusting eggs with 12 per cent. DNC at about 50 lb. per acre did not noticeably reduce hatching. Treatment with 25 per cent. killed the eggs with which the dust came in contact and on which it stayed throughout the incubation period but had no effect on the eggs inside the mass.

On the basis of these results, it is concluded that field control of *D. variabilis* with DNC or its ammonium salt would probably be difficult but not impossible.

As eggs hatch over a long period during warm weather, only repeated dusting over several months could take advantage of the susceptibility of the young larvae.

HARVILL (E. K.) & ARTHUR (J. M.). **Toxicity of Organic Compounds to Houseflies.**—*Contr. Boyce Thompson Inst.* **13** no. 2 pp. 79–86, 5 refs. Menasha, Wis., 1943.

HARVILL (E. K.), HARTZELL (A.) & ARTHUR (J. M.). **Toxicity of Piperine Solutions to Houseflies.**—*T. c.* pp. 87–92, 11 refs.

The following are the authors' summaries. The toxicity of allyl phenols and the γ-thiocyanopropyl and β-thiocyanoethyl ethers of various phenols to houseflies (*Musca domestica*, L.) as determined by the Peet-Grady method is presented by the formula of their dosage-mortality curves [*R.A.E.*, A **23** 493]. Allyl phenols were found to possess insecticidal properties. Increasing the number of nuclear allyl groups increased the toxicity of the phenol to flies. The median lethal doses for o-allylphenol, o,o′-diallylphenol, and o,o′,p-triallylphenol were 18·5, 10·5 and 2·63 per cent., respectively. The γ-thiocyanopropyl and β-thiocyanoethyl ethers of phenols were very toxic to flies and had a very rapid paralysing effect. Their median lethal doses varied between 0·60 and 1·33 per cent. The γ-thiocyanopropyl ether of 1,3,5-xylenol was found to be an excellent toxicant for use in household fly sprays because of its toxicity (median lethal dose 0·79 per cent.), rapid paralysing effect and lack of objectionable odour.

Piperine, the alkaloid found in the dried fruit of black pepper [*Piper nigrum*], is more toxic than pyrethrum to house-flies. At concentrations of 0·10 per cent., piperine killed 75·0 per cent. and the pyrethrins 51·1 per cent. of the flies by the Peet-Grady method. Peet-Grady tests were made by mixing piperine and pyrethrum in various proportions. Fly-sprays containing 0·05 per cent. piperine and 0·01 per cent. pyrethrins were more toxic than sprays containing pyrethrins alone at a concentration of 0·10 per cent. Peet-Grady tests were made of solutions of various substituted amides and pyrethrum. The presence of a methylenedioxyphenyl group increased the effectiveness of the amides. Amides of piperic acid were more effective than the amides of cinnamenylacrylic acid in increasing the toxicity of pyrethrum solutions. Increasing the side-chain attached to the methylenedioxyphenyl group increased the effectiveness of the amide. Piperine was more effective than the piperidide of 3,4-methylenedioxybenzoic acid in increasing the toxicity of pyrethrum solutions.

DEONIER (C. C.). **Biology of the immature Stages of the Clear Lake Gnat (Diptera, Culicidae).**—*Ann. ent. Soc. Amer.* **36** no. 3 pp. 383–388, 3 figs., 8 refs. Columbus, Ohio, 1943.

These observations on the bionomics of *Chaoborus astictopus*, Dyar & Shann., were carried out from 1939 to 1941 in Clear Lake, California, and under controlled conditions. Eggs, on the surface and under water [*cf. R.A.E.*, B **31** 48], usually hatched in 20–24 hours in summer. The newly hatched larvae were free-swimming and apparently did not migrate to the bottom mud during the day as did those in the later instars. They were not observed to feed until 3 days after hatching in May 1940 when the water temperature was 63°F. The first instar occupied more than 8 days in the lake, and the shortest period of development from egg to fourth instar was 18 days. The durations of the first three instars in the laboratory at 70 and 80°F. are shown in a table. The fourth instar varied in duration from 2 days to 9 months. Development was checked and pupation prevented by reducing the temperature to below 60°F. or

withholding food. With an abundance of plankton and temperatures of 70–80°F., the larval period lasted 11–25 days. Overwintering larvae from the lake were forced to pupate during the winter by placing them in a medium at 70-80°F. and supplying abundant plankton containing Copepods. The pupal period lasted 2–3 days. The four larval instars are described, and the feeding habits are discussed. Newly-hatched larvae fed almost entirely on Rotifers, second-instar larvae on immature Copepods and Rotifers and third- and fourth-instar larvae on Copepods.

GOULD (G. E.). **Replacement Materials for Roach Control.**—*Soap* **19** no. 8 pp. 90–93, 111, 5 refs. New York, N.Y., 1943.

Owing to the scarcity of sodium fluoride and pyrethrum, which have given excellent control of cockroaches, both separately and in combination, investigations were made on materials to replace or dilute them. The test insect was the German cockroach [*Blattella germanica*, L.], and the method was a modification of that of Dewey [*R.A.E.*, B **31** 8].

The following is based on the author's summary of the more promising results. A fluffy, finely-ground sodium fluosilicate can be used as a substitute for sodium fluoride, but must be applied at a greater strength. Samples of small particle size usually gave a better kill than those with larger particles. A light, finely-ground sodium fluosilicate diluted with an equal amount of pyrophyllite should give effective control. A finely powdered boric acid gave fairly good kill in 96 hours and was much better than borax. It was slower in action than sodium fluoride, although the addition to it of powdered sugar increased the percentage kill somewhat. A mixture of boric acid of the impalpable grade, pyrethrum powder and pyrophyllite (50 : 20 : 30) is recommended for places where sodium fluoride or sodium fluosilicate cannot be used. Only 2,4-dinitroanisole was as effective as sodium fluoride or pyrethrum. At a strength of only 10 per cent. with pyrophyllite, it caused greater mortality than sodium fluoride. Pyrophyllite, starch and acid type dextrine were excellent diluents when finely ground, good results being obtained with mixtures containing as little as 25 per cent. sodium fluoride or 15–20 per cent. pyrethrum.

STAUBLY (J. L.) & LLOYD (A. C.). **Drycleaning as a Means of delousing Garments.**—*Soap* **19** no. 8 pp. 94–96, 3 refs. New York, N.Y., 1943.

A typical commercial dry-cleaning process is described. The article is washed by mechanical agitation in cleaning fluid, most of the fluid is extracted from it in a basket type centrifuge and it is then dried or deodorised in a hot-air tumbler (a perforated cylindrical basket that rotates about a horizontal axis while heated air is blown through it). The fluid used in the tests described was Stoddard solvent, a petroleum distillate with a closed-cup flash point of 100°F. or over and in general a distillation range of 300–410°F. Immersion in it gave complete kill of lice [*Pediculus humanus*, L.] in less than 5 minutes, but was not effective against their eggs. Complete kill of eggs of all ages was, however, obtained by tumbling clothes containing them under various conditions for periods not exceeding 30 minutes at temperatures of not more than 160°F. This is in accordance with present recommendations for dry cleaning. The shortest exposures were 16 minutes with the temperature rising from 107 to 160°F., and 10 minutes with the temperature at 160°. Adult lice as well as eggs were subjected to the 16-minute exposure, and all were killed. Therefore, any dry-cleaning plant equipped with a hot air tumbler can clean garments and destroy all lice and their eggs at the same time without the use of any special equipment or treatment and without damaging the garments.

Griffiths jr. (J. T.) & Tauber (O. E.). **Evaluation of Sodium Fluoride as a Stomach Poison and as a Contact Insecticide against the Roach** *Periplaneta americana* **L.**—*J. econ. Ent.* **36** no. 4 pp. 536–540, 1 fig., 6 refs. Menasha, Wis., 1943.

Experiments in which adults of *Periplaneta americana*, L., were given access to starch paste containing 1, 2·5, 5 or 7·5 per cent. sodium fluoride showed that this material acts as a stomach poison [*cf. R.A.E.*, B **29** 144; **30** 194]. Cockroaches that appeared to have walked in the poisoned starch to an excessive degree were eliminated from the experiment. The average survival times after ingestion of the various pastes were 6·5, 5·0, 3·4 and 3·5 days, females living longer than males. Most of the starved controls were alive after 10 days. When the cockroaches were allowed to walk through an even deposit of sodium fluoride for 15 seconds, there was a correlation between the amount collected on the body surface and the interval before death occurred. It was most marked when the amount was less than 4 mg. per gm. body weight. Cockroaches with unsealed mouth-parts did not die sooner than others with sealed mouth-parts [*cf. locc. citt.*]. The average period of survival after contact with the sodium fluoride was about 33 hours for males and 52 hours for females. This experiment showed that the cleaning of appendages is of negligible importance in contributing to mortality, as death occurs from the effect of contact before the ingested sodium fluoride can act.

Richardson (H. H.). **The Action of Bean Leaves against the Bedbug.**—*J. econ. Ent.* **36** no. 4 pp. 543–545, 3 figs., 5 refs. Menasha, Wis., 1943.

Bean leaves are used in the Balkans as traps for *Cimex lectularius*, L. [*R.A.E.*, B **15** 177]. To determine whether there is an attractive or toxic principle in them, tests were made in which batches of 24–273 bugs were confined overnight in pans on which were spread 3 or 4 freshly picked leaves of *Phaseolus vulgaris* and the same number of squares of white blotting paper of equal area. The next morning, about 68 per cent. of the bugs were under the blotting paper and the remainder on the leaves, trapped by minute hooked hairs. Once trapped, they could seldom free themselves except by moulting, but if freed, they moved away rapidly and apparently quite normal. This and the fact that they lived for several days on the leaves and eventually died of hunger indicated that the leaves were not toxic. Adults as well as nymphs were trapped, and as soon as several were caught the herding instinct caused many others to join them. Bugs were also trapped on pods of *Desmodium* sp., which bear larger hooks than bean leaves, but not on leaves of lucerne, coleus, chrysanthemum, fuchsia and white clover, which have none. It is concluded that large populations of *C. lectularius* could probably be reduced by trapping with bean leaves, but as eggs would not be affected, it is doubtful whether extermination could be accomplished by this method.

Huffaker (C. B.) & Back (R. C.). **A Study of Methods of sampling Mosquito Populations.**—*J. econ. Ent.* **36** no. 4 pp. 561–569, 11 refs. Menasha, Wis., 1943.

The following is mainly based on the authors' summary. A study of the mosquito populations near Fort DuPont, Delaware, was made at intervals of 7–10 days from early July to late September 1942 to determine the reliance that can be placed on catches made in New Jersey suction light-traps [*R.A.E.*, B **31** 195], as indications of the composition of the populations. The traps were operated in the usual manner with a white, frosted, 25-watt light bulb as the attractant, and also with both light and carbon dioxide [**31** 74], with carbon dioxide alone and with the fan in operation but no attractant. For comparison, catches were made of mosquitos attempting to feed on man and

resting in a cattle barn and in nail kegs [**31** 52], and collections were also made by sweeping. All the results, involving 49,053 mosquitos, are given in a table. They showed that none of the methods can be depended upon for an adequate, non-selective analysis of a heterogeneous mosquito population. A trap with no attractant gave the best qualitative results, but caught too few mosquitos to be of practical use. The light-traps did not catch a representative sample of a mixed population. *Anopheles quadrimaculatus*, Say, varied more in response than any other species. It formed 8·4 per cent. of the total catch in the trap with carbon dioxide and light, about 10 per cent. in traps with light only, 92·9 per cent. in the barn and 97·2 per cent. in kegs. *Culex salinarius*, Coq., which was twice as abundant in the general population, was not caught in appreciable numbers in the barn or kegs, but formed 71·9 per cent. of the catch in the trap with carbon dioxide and light. Other species showed marked differences in response. The catches from resting quarters showed the highest degree of specific selection of any method used. Nevertheless, examination of such quarters is considered preferable to the use of light-traps for estimating the density of populations of *A. quadrimaculatus*. On the basis of comparison with catches by the least selective method used, *A. walkeri*, Theo., was caught about 14 times as readily as *A. quadrimaculatus* by the New Jersey trap with light only, catches of other species falling between these extremes. The relative attractiveness of this trap to the various species taken is shown in a table, and a method is given for correcting the records obtained in such traps, which may be practicable for use in large-scale survey work. The trap was more effective in catching *A. quadrimaculatus* on dark nights than on light ones. On light nights, carbon dioxide alone was more attractive than carbon dioxide and light or light alone. The activity of *A. quadrimaculatus* continued relatively unabated for two hours or more in the evening after that of many other species had greatly declined. Unlike females, male mosquitos are definitely repelled by carbon dioxide.

Smith (C. N.) & Cole (M. M.). **Studies of Parasites of the American Dog Tick.**—*J. econ. Ent.* **36** no. 4 pp. 569–572, 8 refs. Menasha, Wis., 1943.

Attempts to control ticks in the United States by means of *Hunterellus hookeri*, How. (*Ixodiphagus caucurtei*, Du Buyss.) are briefly reviewed [*R.A.E.*, B **16** 133; **19** 137; **22** 144; **30** 140]. One male and 4 females emerged from a nymph of *Ixodes ricinus* var. *scapularis*, Say, collected on a meadow mouse [*Microtus*] in 1941 on the Elizabeth Islands, Massachusetts, where a strain was released in 1926 [*cf.* **16** 133; **30** 140], but 284 other nymphs of this species and 2,143 of *Dermacentor variabilis*, Say, were not infested and both ticks remain abundant. Although results were not encouraging, some 90,000 females were liberated in two localities on Martha's Vineyard, Massachusetts, in 1937–39 in an attempt to control *D. variabilis*. Notes are given on the biology of the parasite, based on observations made in the course of rearing the stock for release.

The strain originated from *Rhipicephalus sanguineus*, Latr., in Texas, and the hosts were nymphs of *D. variabilis* unless otherwise stated. A temperature of 80°F. and a relative humidity of 70 per cent. provided optimum conditions. The period from dropping of engorged, parasitised nymphs to emergence of parasites was 20–30 days. The average number of parasites emerging from one nymph was 2 males and 18 females. Parasites were not injured by exposure of the parasitised nymphs to temperatures of 50 and 60°F. for 19–21 days soon after the nymphs dropped, but they were all or nearly all killed when a period of 12–22 days intervened, or when exposed to 40°F. for 19 days. Records on the survival of immature parasites in ticks stored at intermediate temperatures are summarised. No parasites survived the winter out-of-doors in the experimental rearing. Adult parasites lived 24–48 hours at 80°F., 6 days at 60°, 23

days at 50° and 6 days at 40°, but were killed by 24 hours or over at 35°. Nymphs exposed on mice in the open 10–100 ft. from emerging parasites were not attacked. Parasites emerged from 1 out of 40 nymphs of *I. muris*, Bishopp & Smith, and 1 of 21 of *Haemaphysalis leporis-palustris*, Pack., but from none of 67 nymphs of *I. dentatus*, Marx, exposed to active adult parasites while engorging on rodents in cages. Stocks for release were obtained most easily by exposing nymphs of *D. variabilis* during the second and third days of engorgement on meadow mice and keeping the engorged ticks in moist sand. In this way, 25 generations were reared, but there was a marked reduction in vitality during the last few. Sometimes the parasites were allowed to emerge in the laboratory and were then released, sometimes parasitised nymphs were exposed in mouse runs in gauze cages that allowed the parasites to escape but retained the ticks for inspection, and sometimes mice were caught, infested with nymphs that were then exposed to parasitism and set free at the point of capture. No parasites were recovered in ticks collected in the areas of release from 1937 to 1942, and no reduction in tick abundance attributable to the parasites was observed.

Ixodiphagus texanus, How., an indigenous species, was found in one larva and six nymphs of *D. variabilis* on the Elizabeth Islands but was not taken in this tick on Martha's Vineyard, where it has however been found in other species.

King (W. V.), Roth (L.), Toffaleti (J.) & Middlekauff (W. W.). **New Distribution Records for the Mosquitoes of the southeastern United States during 1942.**—*J. econ. Ent.* **36** no. 4 pp. 573–577, 6 refs. Menasha, Wis., 1943.

The table drawn up by King, Bradley and McNeel to show the distribution of the various species of mosquitos occurring in the south-eastern United States [*R.A.E.*, B **31** 232] is revised to include new records made during 1942, when an extensive collecting programme was carried out and 204,679 adults and 39,498 larvae were identified, and three records made by Carpenter in Arkansas [**31** 94]. A list is also given of the specific records on which the alterations in the table are based, showing the place and method of collection, number of individuals taken, their sex if adult, and the date of capture. *Anopheles crucians georgianus*, King, which had previously been recorded from Georgia only, was taken also in Alabama, Florida, Louisiana, Mississippi, North Carolina and South Carolina, and *A. atropos*, D. & K., is recorded for the first time from North Carolina, *A. crucians bradleyi*, King, from Georgia, and *A. walkeri*, Theo., from Mississippi.

King (W. V.). **Some entomological Aspects of Troop Mobilization.**—*J. econ. Ent.* **36** no. 4 pp. 577–580. Menasha, Wis., 1943.

The relationship of war conditions to insect-borne disease is considered with particular reference to malaria, plague, typhus, yellow fever and intestinal diseases mechanically transmitted by flies. The employment of entomologists in the army and the opportunity that entomologists now have to make a contribution to the prevention of disease are also discussed.

Shields (S. E.) & Hull (J. B.). **The seasonal Incidence of Sand Flies in Florida.** —*J. econ. Ent.* **36** no. 4 pp. 625–626, 1 fig., 1 ref. Menasha, Wis., 1943.

The measures now in use for the control of sandflies [*Culicoides*] in Florida are diking the salt marshes in which they breed to prevent the entry of tide water and removing rain water from the marshes by pumping [*R.A.E.*, B **32** 20]. If breeding could be stopped by drying the marshes just before adult emergence only, the cost of control would be greatly reduced. With a view to ascertaining

when the largest numbers of adults emerge, recovery cages were placed in and near drainage ditches in four marshes of pickleweed (*Batis maritima*) and four of red mangrove (*Rhizophora mangle*) in 1939–41. Emergence was greatest for a short period between late November or early December and late December or early January, and was also considerable between April and August, with the peak in June. The winter peak occurs when weather conditions prevent the sandflies from being very active, but the weather during the second peak period is favourable for migration to residential areas.

Bustamante (M. E.) & Varela (G.). **Una nueva rickettsiosis en México. Existencia de la fiebre manchada americana en los Estados de Sinaloa y Sonora.** [A new Rickettsiasis in Mexico. The Existence of American Spotted Fever in the States of Sinaloa and Sonora.]—*Rev. Inst. Salub. Enferm. trop.* **4** no. 3 pp. 189–210, 1 col. pl., 1 map, 4 graphs, 10 refs. Mexico, D.F., 1943. (With a Summary in English.)

Investigations were begun in 1942–43 on the identity of a rickettsial disease, the history of which is reviewed, that causes a comparatively high rate of mortality among the inhabitants of some settlements in western Mexico. Since the number of cases increases during summer and autumn, reaching a peak in November and December, injection of blood from a patient and subinoculation produced symptoms in healthy guineapigs and also in one that had recovered from Mexican orchitic typhus [*cf. R.A.E.*, B **20** 245], but not in those into which Rocky Mountain spotted fever vaccine had been injected, and the disease persists in rural areas, it is concluded that it is identical with Rocky Mountain spotted fever. In a search for possible vectors, *Argas persicus*, Oken, *Boophilus annulatus*, Say, and *Rhipicephalus sanguineus*, Latr., were taken in various settlements, and experiments on the ability of these ticks to transmit the disease are to be made. A comparative table based on the literature is given showing various characteristics in guineapigs of the Mexican strain and of strains of spotted fever from the Bitter Root Valley (Montana), the eastern United States, Minnesota, Tobia [*cf.* **31** 42] and São Paulo [*cf.* **21** 276]. It is considered that they represent a single disease, and the name American spotted fever is proposed for it.

Varela (G.) & Mazzotti (L.). **Conservación del virus del tifo en *Triatoma barberi* Usinger, 1939.** [The Maintenance of the causal Agent of Typhus in *T. barberi*.]—*Rev. Inst. Salub. Enferm. trop.* **4** no. 3 pp. 211–213, 2 refs. Mexico, D.F., 1943. (With a Summary in English.)

Individuals of *Triatoma barberi*, Usinger, that had fed on a guineapig experimentally infected with Mexican orchitic typhus [*cf. R.A.E.*, B **20** 245] were crushed after 1–33 days and inoculated into healthy guineapigs. It was found that the infection persisted in the bug for 33 days.

Vargas (L.). *Anopheles earlei* **Vargas, 1942, n. sp. norteamericana del grupo *maculipennis*.**—*Bol. Ofic. sanit. panamer.* **22** no. 1 pp. 8–12, 6 figs., 19 refs. Washington, D.C., 1943. (With a Summary in English.) **El "grupo *maculipennis*" del nuevo mundo y el *Anopheles earlei*.**—*Rev. Inst. Salub. Enferm. trop.* **4** no. 3 pp. 279–284, 2 pls., 3 refs. Mexico, D.F., 1943. (With a Summary in English.)

In the first of these papers, the author discusses the status of *Anopheles maculipennis*, Mg., vars. *aztecus*, Hoffm., *freeborni*, Aitken, and *occidentalis*, D. & K., which he considers distinct species, and gives characters of the male genitalia distinguishing from *occidentalis* another form for which he proposes the name

A. earlei, sp. n. The type locality of the new form is Jefferson County, Wisconsin, and it is thought to occur east of the Rocky Mountains along the border between Canada and the United States as far as the Atlantic coast [*cf. R.A.E.*, B **30** 154].

In the second, he gives notes on the classification of these four forms and of *A. atropos*, D. & K., *A. walkeri*, Theo., and *A. quadrimaculatus*, Say, together with keys to the females and (except for *occidentalis*, of which he had insufficient material) to the larvae and the terminalia of the males. A larva of *earlei* was taken in Cayuga Lake, New York.

Ross (E. S.) & Roberts (H. R.). **Mosquito Atlas. Part I. The Nearctic *Anopheles*, important Malaria Vectors of the Americas and *Aëdes aegypti*, *Culex quinquefasciatus*.**—iv+44 pp., illus. Philadelphia, Pa., Amer. ent. Soc., 1943. **Part II. Eighteen Old World Anophelines important to Malaria.** —iv+44 pp., illus. Price 60 *cts.* each.

The work of which these are the first parts is designed to give information on the morphology of mosquitos in a simplified and concise form. Most of the space is occupied by figures, which are accompanied by notes on the chief diagnostic characters. Indications of habits, habitat and distribution and importance as a vector of disease if any are included. Each species is dealt with on a single loose-leaf sheet, the adult on one side and the larva on the other, so that changes and additions can be made indefinitely.

Part I includes the Nearctic species and varieties of *Anopheles* ; the important vectors of malaria in America, which comprise *A. maculipennis freeborni*, Aitken, *A. quadrimaculatus*, Say, *A. pseudopunctipennis*, Theo., *A. punctimacula*, D. & K., *A. darlingi*, Root, *A. albitarsis*, Arrib., *A. aquasalis*, Curry, *A. albimanus*, Wied., and *A. bellator*, D. & K. ; *A. gambiae*, Giles, because of the possibility of its reappearance in North or South America ; and *Aëdes aegypti*, L., and *Culex fatigans*, Wied. (*quinquefasciatus*, auct.). Notes on preparing material for study, killing, storing and mounting are also given.

The species similarly dealt with in the second part are *Anopheles sacharovi*, Favr, *A. claviger*, Mg., *A. hyrcanus*, Pall., *A. umbrosus*, Theo., *A. annulipes*, Wlk., *A. punctulatus*, Dön., *A. culicifacies*, Giles, *A. funestus*, Giles, *A. fluviatilis*, James, *A. minimus*, Theo., *A. subpictus*, Grassi, *A. sundaicus*, Rdnw., *A. multicolor*, Camb., *A. superpictus*, Grassi, *A. stephensi*, List., *A. annularis*, Wulp, *A. maculatus*, Theo., and *A. pharoensis*, Theo. A list is also given of the Old World species of *Anopheles*, arranged under the three main geographical areas.

Cameron (A. E.). **Insect Pests of 1942.**—*Trans. Highl. agric. Soc. Scot.* 1943 repr. 25 pp., 18 figs., 5 refs. Edinburgh, 1943.

This report on insect pests in Scotland includes notes on the biology of horse bot flies (*Gastrophilus* spp.), ox warble flies (*Hypoderma lineatum*, Vill., and *H. bovis*, Deg.) and the sheep nostril fly, *Oestrus* (*Cephalomyia*) *ovis*, L., and the control of *Gastrophilus* and *Hypoderma*. Characters distinguishing the adults and eggs of *G. intestinalis*, Deg., *G. nasalis*, L., and *G. haemorrhoidalis*, L., the three species of *Gastrophilus* that occur in Britain, are also given.

Irdem (E.). **Türkiyede** *Anoph. sergenti*. [*Anopheles sergenti* in Turkey.]—*Rev. Hyg.* **17** no. 104 pp. 296-297, 9 refs. Ankara, 1942. (With a Summary in French.) [Recd. 1944.]

Larvae of *Anopheles sergenti*, Theo., were found in water in hoof-prints at a locality about 12½ miles north of Antioch in October 1940. This Anopheline had not previously been recorded from Turkey and usually inhabits desert territory. Larvae of *A. superpictus*, Grassi, were taken with them in some cases.

Gregson (J. D.). **The Enigma of Tick Paralysis.**—*Proc. ent. Soc. B.C.* **40** pp. 19–23, 20 refs. Vernon, B.C., 1943.

Tick paralysis in British Columbia is a flaccid ascending motor paralysis [*R.A.E.*, B **25** 178] that may be produced in livestock or man by the feeding of one female or more of *Dermacentor andersoni*, Stiles. The tick occurs in other parts of Canada [**28** 216] and in the United States, but the paralysis is scarce there, being almost confined to the ranching areas of British Columbia [but *cf.* **25** 178]. The symptoms appear about the sixth day after the tick has attached, and increase until it drops off replete or is removed. After this, recovery is usually rapid, but death may ensue if the respiratory centre becomes paralysed before the tick leaves the host. Paralysis caused by other ticks occurs in Australia [**30** 28], South Africa and Jugoslavia [**25** 250]. Of the three main theories as to its cause, the most generally accepted is that paralysis of the nervous system results from the introduction of a toxin by the tick. This is supported by the course of illness in British Columbia and, on the assumption that the disease in Australia is similar, by observations there [**23** 159]. However, the Australian disease appears to be more often fatal, and according to I. C. Ross, it may become apparent after the ticks are removed. Some animals in British Columbia are paralysed by a single tick while others can tolerate several dozen fast-feeding ones [**25** 178] with no ill effects, and it is shown that immunity cannot account for this. The fact that only ticks in certain territories, and of these only certain individuals, produce paralysis suggests that some tick-borne agent is involved. The lapse of time between attachment and the onset of paralysis accords with this explanation, but the rapid recovery that follows the removal of the tick does not. The theory that the cause is mechanical injury occasioned by the ticks feeding on the nervous system has much support because the ticks often congregate along the spine of the animal as they are negatively geotropic when unfed. Paralysis may, however, set in when the tick is attached to any part of the body.

It is suggested that the toxin may be a glandular secretion to aid in the release of the tick's mouth-parts or a regurgitated liquid, and that it is readily destroyed by the host. When salivary glands dissected from fast-feeding examples of *D. andersoni*, frozen on removal from the host, were injected intravenously and subcutaneously into mice and lambs and intraspinally into puppies, only negative results were obtained even when several times as many glands were involved as were used by Ross [**23** 159], and injection into lambs of crushed bodies of ticks that were known to have produced paralysis also gave negative results. If animals exposed to attack by ticks for several years acquire an immunity, so that those attacking them do not feed very readily [*cf.* **27** 172, etc.], this might lessen the risk of paralysis by eliminating fast feeding. However, some ticks were unable to feed rapidly on Vancouver Island sheep, generations of which had been free from attack. Instances of individual host susceptibility were noted, but variation in the rate of feeding is largely due to the tick. It appears that only certain ticks, usually fast-feeding ones, can produce paralysis. An attempt to estimate the percentage of virulent ticks in a locality where paralysis normally occurs failed. Ticks become less able to feed readily as mid-summer and autumn approach [**25** 178]. The relation of temperature and light to tick behaviour is discussed from the literature [**24** 136].

Paper noticed by Title only.

Hixson (H.). **The Tropical Bedbug established in Florida.** [Records of *Cimex hemiptera*, F., in houses in several localities in 1938–42.]—*Florida Ent.* **26** no. 3 p. 47. Gainesville, Fla., 1943.

Entomological Investigations.—*16th Rep. Coun. sci. industr. Res. Aust. 1941–42* pp. 14–21. Canberra [1943]. **Animal Health and Nutrition Investigations.** —*T.c.* pp. 21–25.

Work on sheep blowflies was continued during 1941–42 [*cf. R.A.E.*, B **31** 30], and the boric acid, tar oil and bentonite dressing (B.T.B. 15) was used extensively in the field with excellent results. The tar oil fraction originally recommended [**30** 53] is not now available, but a mixture of equal parts of kerosene and certain creosote or middle oils was found to be a highly satisfactory substitute. However, the contact toxicity of this dressing is not high. Samples of unprocessed Australian bentonites were not so satisfactory in the dressings as the processed American bentonites. In continued work on repellents, the effectiveness of 10 per cent. Ceylon citronella oil in liquid paraffin was confirmed. One out of four fractions of it, consisting largely of geraniol and citronella (7 : 3), was as effective as the whole oil, of which it forms about one-third. Seven out of a further 17 substances had some repellent effect. Pure oleic acid was repellent, but commercial oleic acid was not. The observation that carcasses of sheep do not produce many adults of *Lucilia cuprina*, Wied., was confirmed in the Canberra district. Trapping in the areas relatively free from sheep on the coast adjacent to Canberra indicated that the population of *L. cuprina* is about 5–6 per cent. of what it would probably be if sheep were present. The density of this species was estimated four times during the season in an area of 50 sq. miles typical of the open grazing country in the Canberra district by liberating a known number of stained flies in the centre of a circle with a radius of 4 miles containing 102 equally spaced traps, and calculating the natural density from the ratio of stained to unstained flies in the traps during the period for which most of the stained flies remained within the circle. Densities ranging from 0·4 to 2·5 adults per acre were found at different times of the year. There were significant differences between populations of different areas within the circle. Freshly baited traps placed at intervals of $\frac{3}{4}$-mile caught 1–4 per cent. of the population of *L. cuprina* each day, so that the possibility of effectively reducing the population of this species by traps appears to be remote. Observations on the effects of length of tail [*cf.* **31** 29] and Mules' operation on infestation of sheep show the great value of the operation combined with a tail 4 inches long. In two groups of ewes on which observations were begun in 1939 and 1940, respectively, the percentages struck among those with tails of this length were 1·9 and 0·9 in operated ewes and 21·1 and 19·2 in control ones. Ewes with tails of other lengths and ewes on which the operation had not been performed always had more strike than the otherwise comparable ones.

Damalinia (*Bovicola*) *ovis*, L., was successfully reared without keeping it on sheep. It appears to subsist for the most part on the waxy material adhering to the wool fibres. The life-cycle occupied 40–55 days at 38°C. [100·4°F.], the most favourable temperature. Three developmental instars were recorded. Of several dipping agents tested against *Psorergates ovis*, Womersley [*cf.* **31** 249], lime-sulphur (calcium polysulphide) at a concentration of 0·4 per cent. polysulphide killed all the mites. Good results were obtained in a field trial with a dip containing about 1 per cent. sulphide sulphur, but the wetting about the back of the head was poor in three heavily infested sheep, and live mites were recovered from this area. Chorioptic mange in sheep [caused by *Chorioptes ovis*, Raill.] was observed during the year. This is thought to be the first time it has been recorded from Australia.

Work on the bionomics of the cattle tick, *Boophilus annulatus microplus*, Can. (*australis*, Fuller) was continued [**31** 31]. The lowest temperature at which eggs hatched was 16·5°C. [61·7°F.], but some development occurred at lower temperatures. The non-parasitic period of the life-cycle may last 18–359 days and parasitic periods of the larvae, nymphs and adults 5–10, 7–11 and 6–14 days, respectively. In experiments on control of "resistant" ticks

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[*cf.* **31** 122], promising results were obtained with dips containing sulphuric acid as well as sodium arsenite, and 0·4 per cent. sulphuric acid did not harm the cattle. Among ten oils and five arsenical solutions tested as contact insecticides for use against larvae of *Musca domestica*, L., and blowflies, several coal tar fractions proved effective, and middle oil (boiling range 200–260°C.) was the most suitable of them. Powdered naphthalene or pyrethrum, sprinkled at the rate of 1 oz. per 5 sq. yards, killed larvae and adults of *Ctenocephalides* (*Ctenocephalus*) *felis*, Bch., and fly-spray was also effective against the adult fleas.

Lumley (G. F.) & Taylor (F. H.). **Dengue. Part I. Medical. Part II. Entomological.**—*Serv. Publ.* (*Sch. publ. Hlth trop. Med.*) *Dep. Hlth Aust.* no. 3, 171 pp., 2 fldg. maps, illus., refs. Sydney, 1943.

All the available information on dengue in Australia is assembled in this comprehensive publication, which is designed particularly to disseminate knowledge on the methods of spread of the disease so that the co-operation of the public may be obtained in preventing its occurrence. In the first part (by Lumley, pp. 1–141), the clinical aspect is dealt with at length, and the history, geographical distribution and etiology of the disease, immunity, the possibility of transmitting infection to animals [*cf. R.A.E.*, B **18** 40] and the part played by mosquitos in transmission are discussed, mainly from the literature. The section relating to transmission is particularly detailed and covers research from 1902 onwards. Among the subjects dealt with are transmission by *Aëdes aegypti*, L., the main vector, and *A. albopictus*, Skuse, negative results with *Culex fatigans*, Wied., as an intermediate host [**18** 73; **19** 110], mechanical transmission [**19** 110] and the probability of other mosquitos being proved to be vectors. The final section is on epidemiology and endemiology, which depend in the case of dengue on the virus, the vector, man's susceptibility, reservoirs (man, mosquitos and possibly monkeys) and the effects of preventive measures. It includes a survey of the factors that affect the abundance of *A. aegypti* and the risks of its transport by road, rail, ships or aircraft.

The second part (by Taylor, pp. 142–171) deals principally with identification and is largely quoted. Brief description of the proboscis and thorax of a mosquito is followed by full descriptions of all stages of the genus *Aëdes*, the adult and larva of the subgenus *Stegomyia*, the adult, larva and pupa of *A. aegypti*, and the adult and larva of *A. albopictus*, including variations of *A. aegypti* and notes on hybridisation. There are brief general notes on the habits of the genus and subgenus and fuller ones on feeding, oviposition and other habits of *A. aegypti*, the length of its life, its range of flight, distribution in Australia and dispersal by human agency, and short observations on the distribution, breeding places, oviposition habits and control of *A. albopictus*. Figures are also given of the male and female head and the thorax of *A. notoscriptus*, Skuse, since it is possible to mistake this species for *A. aegypti*.

The author found that *A. aegypti* bit at night as well as during the day in Queensland in 1942. He kept adult females alive for 90 days with regular blood meals in a breeding cage at room temperature at Sydney from the end of September onwards. All males were dead at the end of two months. Dates or sultanas and moisture were provided. In Australia, *A. albopictus* has been found at Darwin in the Northern Territory only. It breeds commonly in bamboo stumps, tree holes, leaf axils and tanks. Decayed infusions of hay, cereals and potatoes are more attractive than pure water for oviposition. The females are more common in the open than indoors and feed by night and by day in a subdued light. Control measures against *A. aegypti* include burying of containers, screening with wire gauze, oiling, spraying against the adults, and the use of mosquito netting. When all domestic breeding places have been dealt

with, females will lay their eggs in rot holes, where breeding of this species and *A. albopictus* may be prevented by the use of sawdust impregnated with coal tar. Notes are given on the preparation of specimens for identification.

Pereira Barretto (M.) & Coutinho (J. O.). **Criação de algumas espécies de anofelinos brasileiros.** [The Rearing of some Species of Brazilian Anophelines.]—*Rev. brasil. Biol.* **3** no. 3 pp. 317–323, 6 refs. Rio de Janeiro, 1943. (With a Summary in English.)

An account is given of breeding experiments with five Brazilian species of *Anopheles* carried out in São Paulo in 1942. The eggs were obtained from females taken in the field and were allowed to hatch in tap water. The larvae were at once transferred to dishes containing infusions in tap water of grains of wheat stripped of their husks, boiled, strained and crushed. The preparation of the infusions is described. They were diluted and renewed daily for first- and second-instar larvae, but used in concentrated form for older larvae and renewed only when the content of infusoria became low. Supplementary foods were not used, although Boyd considers yeast essential for the production of vigorous adults [*cf. R.A.E.*, B **23** 283] and also uses dog biscuit [*cf.* **28** 219]. The pupae were kept in tap water. The best results were obtained with *Anopheles noroestensis*, Galvão & Lane, with 89·5 per cent. adult emergence; the egg, larval and pupal stages lasted 2, 9 and 2 days, respectively. The most favourable temperature for all species was 25–26°C. [77–78·8°F.], and the larvae were the most susceptible to unfavourable conditions during the first instar and just before pupation.

Ayroza Galvão (A. L.) & Damasceno (R. G.). **Sôbre um novo anofelino da Ilha Marajó,** *Anopheles* (*Nyssorhynchus*) *marajoara* **n. sp.** (**Diptera, Culicidae**). [On a new Anopheline, *A. marajoara*, sp. n., from Marajó Island.] —*An. paul. Med. Cirurg.* **44** pp. 424–427. 1942. Also in *Folia clin. biol.* **14** no. 2 pp. 60–66, 2 figs., 3 refs. São Paulo, 1942. (With a Summary in English.) [Recd. 1944.]

The male and larval and pupal exuviae of *Anopheles* (*Nyssorhynchus*) *marajoara*, sp. n., are described from a single specimen reared from a larva taken in Marajó Island, Pará, Brazil, in October 1941 at the edge of a partly shaded pool of muddy water containing floating and erect vegetation, débris, insects and fish. The edges of the pool were trampled by cattle that came there to drink. It was typical of many that are formed in summer by tidal waters that reach far up the river Camará. In winter, the dams that hold these pools are washed away by heavy rain.

Spencer (G. J.). **On the Oviposition Habits of the Australian Cockroach,** *Periplaneta australasiae* (**Fab.**).—*Proc. ent. Soc. B.C.* **40** pp. 29–30. Vernon, B.C., 1943.

Details are given of observations on a gravid female of *Periplaneta australasiae*, F., taken in British Columbia, which, when confined in a cage, laid 17 egg-pods in 100 days. It covered more than half of them with débris and ate some although supplied with food and water.

Davis (D. J.). **Infection in Monkeys with Strains of** *Trypanosoma cruzi* **isolated in the United States.**—*Publ. Hlth Rep.* **58** no. 27 pp. 1006–1010, 1 pl., 7 refs. Washington, D.C., 1943.

Faecal material from three individuals of *Triatoma gerstaeckeri*, Stål, from Texas and two of *T. protracta*, Uhl., from California, all naturally infected with *Trypanosoma cruzi*, two laboratory-reared individuals of *Triatoma gerstaeckeri*

infected with a strain isolated from the same species from Texas and three laboratory-reared individuals of *T. longipes*, Barber, infected with human strains from Panama or Venezuela was dropped on to the intact ocular tissues of ten monkeys (*Macaca mulatta*). Each monkey received material from a single bug, and all became infected. Three of the seven monkeys inoculated with strains from the United States and one of the three inoculated with human strains developed bipalpebral oedema at the site of inoculation [*cf. R.A.E.*, B **29** 192]. Such unilateral oedema is one of the common signs of Chagas' disease.

PARKER (R. R.) & STEINHAUS (E. A.). *Salmonella enteritidis*: **Experimental Transmission by the Rocky Mountain Wood Tick** *Dermacentor andersoni* **Stiles.**—*Publ. Hlth Rep.* **58** no. 27 pp. 1010–1012, 2 refs. Washington, D.C., 1943.

In an attempt to purify a strain of Rocky Mountain spotted fever in guineapigs that had become contaminated with *Salmonella enteritidis*, two lots of adults of *Dermacentor andersoni*, Stiles, were allowed to engorge on a passage animal. However, all the ticks in both lots acquired both organisms and transmitted *S. enteritidis* to all the guineapigs on which they successively fed with one possible exception. The fact that transmission could be effected more than a month after the infective meal suggests that it may not be mechanical. Four partly fed female ticks examined during the experiment were found to harbour *S. enteritidis* in large numbers, and four guineapigs into which faeces from feeding ticks were inoculated developed typical infections. Transmission may be the result of contamination of the skin or bite wound by tick excreta. Many of the ticks died during the experiments, apparently as a result of infection. Tests for *S. enteritidis* in the eggs and progeny of one group of infected females were all negative, but the larvae and nymphs developing from another group transmitted the disease to guineapigs and the *Salmonella* was cultured from the larvae. Samples of the eggs and the adults were negative. It appears possible that *S. enteritidis* occasionally occurs spontaneously in *D. andersoni* in the United States; ticks from nature have several times been suspected of initiating outbreaks of *S. enteritidis* in guineapigs, but it was never certain whether the bacterium was derived from the ticks or the guineapigs. In one such instance the suspected ticks were *Rhipicephalus sanguineus*, Latr.

PRINCE (F. M.). **Report on the Fleas** *Opisocrostis bruneri* **(Baker) and** *Thrassis bacchi* **(Roths.) as Vectors of Plague.**—*Publ. Hlth Rep.* **58** no. 27 pp. 1013–1016, 1 map, 6 refs. Washington, D.C., 1943.

Plague was first shown to be present in the Plains States [*cf. R.A.E.*, B **28** 27] in the autumn of 1941 when it was found in four lots of fleas from the ground squirrel, *Citellus richardsoni*, a susceptible host, in North Dakota. The fleas collected included *Ceratophyllus* (*Opisocrostis*) *tuberculatus*, Baker, *C.* (*O.*) *labis*, J. & R., and *C.* (*Oropsylla*) *rupestris*, Jord., which are known to transmit plague, and *C.* (*Thrassis*) *bacchi*, Roths., which had not previously been tested. The ability of this flea and *C.* (*Opisocrostis*) *bruneri*, Baker, to transmit plague was examined in experiments carried out with 40 examples of the former and 42 of the latter collected from *Citellus richardsoni* and its nests in South Dakota. They were fed on healthy guineapigs on arrival at the laboratory, starved for 48 hours, placed on plague-infected guineapigs and left until the death of the host 2 hours later, and then kept individually in test tubes at 44–76°F. (mean 60°F.) and fed on a healthy guineapig at intervals of 2–3 days until they died or until the experiment ended 75 days later when only three survived. Some died as early as the second day. Transmission was effected 21–34 days after the infecting feed. Altogether, 8 individuals of *Ceratophyllus bruneri* and 10 of

C. bacchi became infected and were so at death, and 4 of each species transmitted infection. Others may have acquired infection and lost it through repeated feeding on healthy guineapigs. It is concluded that these two fleas may be as efficient vectors as *Xenopsylla cheopis*, Roths., and *C.* (*Diamanus*) *montanus*, Baker [*cf.* **30** 33]. Some of the infected fleas that did not transmit the disease had repeated opportunities to do so. *Ceratophyllus bacchi* has been taken on *Citellus richardsoni* in Montana and North Dakota and on *C. tridecemlineatus* in North Dakota, Colorado and Alberta, and *Ceratophyllus bruneri* on *Citellus* sp. in Montana, *C. franklini* and *C. tridecemlineatus* in Nebraska and one or both of these hosts in Colorado, Minnesota, Iowa, Illinois and Wisconsin, so that fleas capable of transmitting plague and hosts that have been found infected or are probably susceptible occur continuously from the Rocky Mountain States and western North Dakota where plague prevails to the States east of the Mississippi River.

Davis (G. E.). **The Tick *Ornithodoros rudis* as a Host to the Rickettsiae of the Spotted Fevers of Colombia, Brazil, and the United States.**—*Publ. Hlth Rep.* **58** no. 27 pp. 1016–1020, 8 refs. Washington, D.C., 1943.

Attempts to obtain transmission of the causal organisms of the immunologically identical spotted fevers of Colombia, Brazil and the United States by the bite of *Ornithodoros rudis*, Karsch, were all unsuccessful. The causal organism of Rocky Mountain (United States) and Brazilian spotted fevers were conserved in the tissues of the tick for 243 and 191 days, respectively, and that of Tobia (Colombia) spotted fever was conserved in the tick for 343 days and was present in the first-stage nymphs of the next generation.

Balch (R. E.) & Hawboldt (L. S.). **Report of Forest Insect Conditions in Nova Scotia in 1942.**—*Rep. Dep. Lds For. N. S. 1942* pp. 50–54, 3 pls. Halifax, N.S., 1943.

This report includes a note on *Dermacentor albipictus*, Pack., which causes the death of many moose in Nova Scotia in late winter. This tick is always present in large numbers on the dying animals. Cattle, horses or deer may also be infested, but not generally so severely. The females oviposit in late winter or early spring, and it is recommended that the carcasses of infested moose and the ground for some 20 ft. round them should be burnt over to destroy the ticks that have left the animal and any eggs or larvae that they may have produced.

Enigk (K.). **Die Ueberträger der Pferdepiroplasmose, ihre Verbreitung und Biologie.** [The Vectors of Equine Piroplasmosis, their Distribution and Biology.]—*Arch. wiss. prakt. Tierheilk.* **78** pt. 3 pp. 209–240, 1 fig., refs. Berlin, 1943.

The author briefly recapitulates the history of the discovery of the transmission by ticks of equine piroplasmosis, caused by *Nuttallia equi* and *Piroplasma caballi*, gives a table based on the literature up to 1940 showing the species that have been found in experiments to transmit them and those that have been regarded as vectors on the basis of circumstantial evidence, and describes experiments carried out in 1941–42 on the ability to transmit these organisms of six species of ticks collected in North Africa (Tripoli) or the Balkans. The only one found naturally infected was *Hyalomma anatolicum*, Koch, from a horse in Macedonia, which transmitted both *N. equi* and *P. caballi* when fed in the adult stage on a horse. In the experiments, the adult offspring of adults of *Rhipicephalus sanguineus*, Latr., *Hyalomma dromedarii*, Koch, and *H. marginatum*, Koch, that had fed on an infected horse transmitted *P. caballi*, and those of *H. anatolicum* transmitted *N. equi*. The latter was also transmitted by adults of

H. dromedarii and *R. sanguineus* that had acquired the infection as nymphs, and both parasites by nymphs of *R. sanguineus*, the only tick tested in this stage after acquiring infection in the preceding one. Adults of *R. bursa*, C. & F., that had acquired the infection as larvae transmitted *P. caballi*. Male ticks as well as females gave positive results. No infection was transmitted by *Boophilus calcaratus*, Bir., or by larvae or nymphs of the daughter generation of the other ticks. Transmission by the immature ticks is considered of no importance, since they are rare on horses in nature.

The geographical distribution of the ticks that are vectors of *N. equi* or *P. caballi* is discussed from the literature, and it is considered that they show no likelihood of spreading to hitherto uninfested regions; their occurrence is restricted by cultivation of infested land and may be reduced by this means. Breeding experiments were carried out in the laboratory at a constant temperature of 25–26°C. [77–78 8°F.] with the two species of *Rhipicephalus* and the three of *Hyalomma*, and the results, including the numbers of eggs laid, the durations of development on and off the host, and the periods of survival without feeding, are shown in a table, together with comparable data from the literature for *Dermacentor reticulatus*, F. (for which the name *D. marginatus*, Sulz., is used) and *D. silvarum*, Olen. In a discussion of the bionomics and host relations of the various ticks, it is stated that the three species of *Hyalomma*, which are normally three-host ticks, completed their development on two hosts in some cases. The percentage that did so increased as the animals selected were more favourable for the development of the immature stages and reached 75 for *H. marginatum* and *H. anatolicum* on rabbit. No influence of season on this behaviour was observed [*cf. R.A.E.*, B **26** 58].

MITSCHERLICH (E.). **Die Kerato-Conjunctivitis infectiosa des Schafes in Deutschland und ihre Beziehungen zur Kerato-Conjunctivitis infectiosa des Rindes.** [Infectious Kerato-conjunctivitis of Sheep in Germany and its Relation to infectious Kerato-conjunctivitis of Cattle.]—*Arch. wiss. prakt. Tierheilk.* **78** pt. 3 pp. 241–244, 1 fig., 14 refs. Berlin, 1943.

An account is given of investigations on the identity of a disease of sheep in Germany that occurs chiefly in summer among grazing animals and has been found to be transmitted within the flock by contact and by insects. It resembles the infectious kerato-conjunctivitis of sheep caused by *Rickettsia conjunctivae* that has been reported from other countries. In the investigations, a rickettsia indistinguishable from *R. conjunctivae* was recovered from the conjunctiva of infected lambs, conjunctival secretion from them infected healthy lambs and calves, and lambs were also infected by secretion from a calf infected with kerato-conjunctivitis of cattle. This is taken as confirmation of the hypothesis that *R. conjunctivae* causes the same disease in cattle [*cf. R.A.E.*, B **32** 55] and sheep.

LUCAS (G. C.). *Demodex folliculorum bovis* (**Stiles**) **Gros. Contribución al estudio histopatológico parasitológico de la sarna folicular de los bovinos.** [*D. bovis*. A Contribution to the histopathological and parasitological Study of follicular Mange in Cattle.]—*Rev. Med. vet.* **22** no. 9–10 pp. 443–461, 24 figs., 21 refs. Buenos Aires, 1940. [Recd. 1944.]

This paper is concerned largely with the subsequent effects on the hides of cattle of infestation by *Demodex bovis*, Stiles, an outbreak of which began in Argentina and Uruguay in 1938, and with the morphology of the various stages of the mite that were found in prepared hides in commercial establishments. The small lesions that are formed in the skin do not disappear but remain as permanent blemishes, so that the only method of avoiding a reduction in the

quality of hides is to prevent infestation, which usually occurs in animals that are out of condition or weakened by other causes. Some evidence was obtained from the hides that dips used against ticks prevent infestation by *Demodex*.

FIORDA (H.). **Sarna "escamosa-oculta" de los lanares. (Nueva forma clínica de sarna ovina en Patagonia.)** [A new Form of Sheep Scab in Patagonia.]—*Rev. Med. vet.* **22** no. 11–12 pp. 583–588. Buenos Aires, 1940. [Recd. 1944.]

The author has made observations in southern Patagonia on an unusual form of mange in sheep and lambs, which apparently occurs also in Tierra del Fuego and depreciates the value of the wool and skin. It is caused by *Psoroptes ovis*, Hering, but infested sheep show no signs of irritation and do not scratch, so that bare patches do not appear. The body may be covered, however, by a layer of scaly crust several millimetres thick, which can be rubbed off like soap flakes. Infestation can sometimes be detected by the whitish coloration and lack of lustre of the wool. If the animals are seized by the wool, those that are infested fall down and are attacked by a fit of trembling that lasts 10–15 minutes and sometimes proves fatal. Attacks of this kind in infested sheep are also induced by contact with hard objects such as a crook, though not by mutual contact in the pens. It sometimes occurs while they are being dipped if they are forcibly submerged, so that they drown. Sheep-farmers assert that infestation is confined to long-wooled breeds, and that arsenical dips are effective for recently infested animals but kill those with infestations of long standing, possibly through absorption of arsenic. Some animals were freed from infestation by dipping them in water, gently pulling out all their wool, and exposing them to the sun in a rich pasture.

ANDERSON (T. F.). **Kala Azar in the East African Forces.**—*E. Afr. med. J.* **20** no. 6 pp. 172–175. Nairobi, 1943.

Visceral leishmaniasis has long been known to be endemic in the Sudan [*cf. R.A.E.*, B **28** 201], but has seldom been recorded from the British East African Territories. Only four cases were reported from the Northern Frontier District of Kenya between 1932 and 1939 inclusive, and records of the occurrence of the disease in Abyssinia and Eritrea were vague. In and after February 1941, 136 African cases among the forces in East Africa were admitted to military hospitals. About 120 of them originated in northern Kenya or southern Abyssinia, three in the Sudan and one in Italian Somaliland. No cases in Europeans were reported. Mortality was 32 per cent. It is calculated that the mean incubation period was three months. Nearly two-thirds of the cases were admitted in July–September, so that infection occurred in April–June, the rainy season. During an entomological survey made in the dry season by V. D. van Someren at camps in a river valley in south-western Abyssinia where 87 of the cases had been contracted, sandflies were taken at three places. All those identified were *Phlebotomus congolensis*, Beq. & Walravens. A brief investigation by G. Maclean revealed ten cases among the indigenous population in the same valley, and Leishman-Donovan bodies were found on spleen puncture in three of them.

GLASGOW (J. P.) & MACINNES (D. G.). *Anopheles* **of British Somaliland.**—*E. Afr. med. J.* **20** no. 6 pp. 176–179, 1 map, 2 refs. Nairobi, 1943.

The topography, climate and streams and wells of British Somaliland are briefly described. The sandy water courses are of a peculiar type, and small sections of some of them contain flowing water or pools throughout the dry season. During a survey made between 17th March and 14th June 1942 [*cf. R.A.E.*, B **32** 47], the only Anopheline caught in considerable numbers in

dwellings was *Anopheles gambiae*, Giles, and there is little doubt that it is the important and probably the only vector of malaria. At one place, it was taken at the rate of 4 per tent. The only other species caught in the adult stage was *A. dthali*, Patt. The larvae taken were *A. gambiae*, *A. dthali*, *A. turkhudi*, List., *A. pretoriensis*, Theo., *A. rhodesiensis*, Theo., and *A. macmahoni*, Evans. The last-named was found also near Diredawa in Abyssinia. Although the period of the investigation included the rainy season, nearly all the larvae were found in permanent water. Epidemics of malaria occur annually in Buramo, and in certain other districts in years of heavy rainfall, owing to the development of Anophelines in rain-water pools. There is a low degree of endemicity in some areas corresponding to the Anopheline breeding in residual water.

Larvae of *Aëdes aegypti*, L., were taken in three places, where they were found in 13·4, 11·5 and 0·6 per cent. of the houses, respectively. *Ornithodoros savignyi*, Aud., was found in three places.

Rodhain (J.) & Lassman (P.). **Le cycle schizogonique de** *Plasmodium schwetzi* **et l'évolution de ce parasite chez** *Anopheles maculipennis* **var.** *atroparvus*.—*Ann. Soc. belge Méd. trop.* **20** pt. 2 pp. 179–186, 1 graph, 3 refs. Brussels, 1940. [Recd. 1944.]

Observations on the asexual developmental cycle of *Plasmodium schwetzi* in a chimpanzee confirmed the finding of Reichenow that it lasts 48 hours and thus agrees with that of *P. vivax* in man. In two experiments to ascertain whether *P. schwetzi* can complete its sexual development in *Anopheles maculipennis* var. *atroparvus*, van Thiel, 107 females that had fed once or twice on a chimpanzee harbouring gametocytes were subsequently dissected at suitable intervals. Only three contained oöcysts on the stomach, and no sporozoites were found in the salivary glands. Two of the three oöcysts were mature, and these were distinctly larger than oöcysts of *Plasmodium vivax*.

Duren (A.). **Contribution à l'étude du paludisme endémique au Congo Belge, district du Kwango.**—*Ann. Soc. belge Méd. trop.* **20** pt. 3 pp. 265–271. Brussels, 1940. (With a Summary in Flemish.) [Recd. 1944.]

Investigations in 1937 in four villages at an altitude of about 3,300 ft. in the centre of the Kwango district showed that the malaria index was low in nurselings, rose to 45 per cent. for persons 11–20 years old and decreased for older groups. This suggests that infection is contracted outside the village, and not in the huts. Almost all the mosquitos taken in the huts were *Anopheles dureni*, Edw.

Nicolay (F.). **Le paludisme à Boma en 1938 et en 1939.**—*Ann. Soc. belge Méd. trop.* **20** pt. 4 pp. 479–488. Brussels, 1940.

Schwetz (J.). **Sur le paludisme à Boma (à propos de l'étude de Nicolay).**—*T.c.* pp. 507–513. (With a Summary in Flemish.) [Recd. 1944.]

In the first paper, the author records the malaria indices for various age groups of the population at Boma, Belgian Congo, in 1938–39. The incidence of the disease decreased with increasing age, but even in adults the percentage infected was 26–46. Early in May 1940, 19 of 20 children (95 per cent.) were infected, whereas early in April the percentage had been 59. In May, the percentages of salivary gland infection in *Anopheles gambiae*, Giles (*costalis*, auct.) and *A. funestus*, Giles, were 14 and 12, respectively, as compared with the annual percentages of 8·9 and 5·9. Adult catches did not indicate a greater mosquito population. *A. pharoensis*, Theo., and *A. nili*, Theo., were of secondary importance, the former because of its low percentage of infection and the latter because of its small numbers. The author suggests that in addition to the

parasite and Anopheline factors, there is also a human factor, health being generally poor at the end of the rainy season and resistance to disease possibly reduced.

The author of the second paper compares the malaria indices recorded by himself at Boma in 1936 with those noted by Nicolay in 1939. He concludes that no marked change had occurred, and that there is no substantial seasonal variation in infection, since the nearness of the river and the low altitude reduce the effect of the dry season on mosquitos in general and on *A. funestus* in particular.

RODHAIN (J.). **Les plasmodiums des anthropoïdes de l'Afrique centrale et leurs relations avec les plasmodiums humains.**—*Ann. Soc. belge Méd. trop.* **20** pt. 4 pp. 489–505, 1 pl., 1 graph, 4 refs. Brussels, 1940. (With a Summary in Flemish.) [Recd. 1944.]

The experiments described were begun with a young male chimpanzee from the Belgian Congo, which, on arrival at Antwerp on 21st August 1939, was found to be infected with *Plasmodium reichenowi* and *P. schwetzi*. This infection was still present on 20th October, and on the following day, parasites of the type described by Brumpt as *P. rodhaini* [*R.A.E.*, B **27** 193] appeared for the first time ; they disappeared after 9th November. On 27th October and 3rd November, blood from this animal was inoculated intravenously into a female chimpanzee that had previously been infected with *P. reichenowi* and *P. schwetzi* and had been inoculated in 1938 with human blood rich in *P. falciparum* and *P. vivax*. Parasites of the type of *P. rodhaini* first appeared on 6th December 1939, 40 days after the first inoculation, and were still present on 30th December 1940. Observations showed that their developmental cycle was similar in duration to that of *P. malariae* in man, and the morphology of the various stages was also similar. On 10th January 1940, blood from this female was inoculated into another female, previously infected with *P. reichenowi* and *P. schwetzi*. On 21st January, this animal was found infected with *P. schwetzi*, but the first parasites of the type of *P. rodhaini* did not appear until 8th March, after an incubation period of 58 days.

In previous experiments, the author had failed to infect chimpanzees with *P. malariae* of human origin. He here gives an account of successful infection of four persons by inoculation of blood from chimpanzees infected with parasites of the type of *P. rodhaini*. In two of them, incubation periods of 18 and 20 days were observed. Four other persons were infected by subinoculation. The course of the infection in man did not differ from those recorded for some human strains of *P. malariae*, and the parasites also resembled *P. malariae* morphologically. It is therefore concluded that *P. rodhaini* is identical with *P. malariae*, so that chimpanzees can serve as reservoirs of the latter.

In previous experiments, the author had been unable to infect man with *P. schwetzi* and he had therefore concluded that it is distinct from *P. vivax*. In the present experiments, however, three persons were inoculated with chimpanzee blood when it contained *P. schwetzi* as well as parasites of the *malariae* type and two of them became infected with forms resembling *schwetzi* or *vivax*.

SIMMONS (J. S.) & AITKEN (T. H. G.). **The Anopheline Mosquitoes of the northern Half of the western Hemisphere and of the Philippine Islands. (Distribution, Habits, Identification, Importance as Vectors, and Control.)**—*Army med. Bull.* no. 59, 205 pp., 5 pls., 2 charts, 19 pp. refs. Carlisle, Pa., 1942. [Recd. 1944.]

The bulk of this work consists of three sections dealing, respectively, with the Anophelines of the nearctic region, those of the neotropical region of Mexico, Central America, Colombia, Venezuela, the Guianas and the Caribbean area

and those of the Philippine Islands. The first two include keys to the males (based on genitalia), females and larvae and the third keys to the adults and larvae. The keys are followed by notes on the distribution, breeding places and habits of each species and its relation to malaria. The final section deals with the planning of mosquito control programmes and the choice of measures with particular reference to military reservations. There are appendices on the preparation and staining of thick blood smears and the dissection of mosquitos for malarial parasites, and on malaria and its treatment, with a note on black-water fever.

GALVIS (A. G.). **Biología y distribución geográfica de los Anophelinos en Colombia.**—*Rev. Fac. Med.* **12** no. 2 repr. 55 pp., 11 figs., 4 maps, refs. Bogotá, 1943. (With a Summary in English.)

A list is given of the two species of *Chagasia* and 27 of *Anopheles* that have been recorded from Colombia, together with keys, based on those of Simmons & Aitken [see preceding abstract] to the males, females and larvae and notes from the literature on their history, distribution in Colombia, taxonomy and in some cases habits, including relation to malaria for the species of *Anopheles* that are vectors. One of the most important vectors is *A. darlingi*, Root, which has been taken at altitudes of up to about 1,600 ft. and is common in dwellings. The larvae were found in sunny pools with floating vegetation. *A. albimanus*, Wied., is considered to be the chief vector in the banana-growing zone. It is a coastal species found up to about 800 ft. and breeds in stagnant clear water containing algae and exposed to the sun, and also in the hoof-prints of cattle. *A. albitarsis*, Arrib., has not been found above 4,000 ft., altitudes of about 160–640 ft. being those most suitable. It seemed to prefer animal blood, and its sporozoite and oöcyst indices were low when large numbers were dissected. *A. pseudopunctipennis*, Theo., and *A. argyritarsis*, R.-D., have been found at higher altitudes than any other species, both occurring at more than 7,000 ft. Neither is apparently of much importance as a vector of malaria. *A. neivai*, H., D. & K., occurred on the Pacific coast only.

PEREIRA BARRETTO (M.). **Estudos sôbre a postura de flebótomos em condições experimentais.** [Studies on Oviposition by *Phlebotomus* under experimental Conditions.]—*Folia clin. biol.* **14** no. 3–4 pp. 87–93, 8 refs. São Paulo, 1942. (With a Summary in English.) [Recd. 1944.]

It is pointed out that most of the methods used for obtaining eggs of *Phlebotomus* in the laboratory are highly artificial and often result in the deposition of only a part of the eggs and the premature death of the female. Two methods were used by the author in São Paulo to obtain oviposition by isolated and grouped females, respectively. In the first method, each female was placed in a tube closed at one end and containing a little moist cotton-wool covered with filter paper at the bottom. The tube was plugged and kept in a humid atmosphere and at a more or less constant temperature, as variations in temperature cause condensation and may result in eggs being laid on the glass from which it is difficult to remove them without injury. The air in the tube should be almost saturated. In the second method, a thick layer of damp filter paper was laid in a petri dish and a glass cylinder open at each end was placed upright on it. The top of the cylinder was closed with a piece of cloth and a strip of dry filter paper inside provided a resting-place for the sandflies, which were introduced through a hole in the cloth cover. Instead of the petri dish lined with filter paper, a porous earthenware dish kept moist at the base may be used. The experiments were carried out in the dark at humidities approaching saturation and usually at laboratory temperature, which varied from 18·5 to 28·5°C. [65·3 to 83·3°F.], but several tests were made at a controlled temperature of 25–27°C. [77–80·6°F.].

The mechanism of oviposition is described. Eggs were usually laid at night over a period of several hours, and many of the females died before oviposition was complete, but this is attributed to experimental conditions. Eggs were sometimes scattered and sometimes stuck together in masses. A feed of sugar solution was not sufficient for the maturation of the ovaries and a blood-meal was necessary. Over 90 per cent. of the females oviposited 7–10 days after the blood-meal, and females of *Phlebotomus whitmani*, Antunes & Coutinho, and *P. intermedius*, Lutz & Neiva, bred in captivity in no case oviposited before the sixth day. The number of eggs laid after one blood-meal by laboratory-bred females varied from 2 to 69 with an average of 23·38 ; one female of *P. guimaraesi*, Coutinho & Barretto, caught in nature laid 118, but the number of eggs that usually mature after a single blood-meal was shown by dissection to be 40–70. The taking of more than one blood-meal or of sugar solution in addition to blood did not significantly affect the number of eggs matured or laid. Some of the females that survived oviposition took a second blood-meal, but others refused to do so, and only 1–2 per cent. took blood-meals and oviposited three times [*cf. R.A.E.*, B **32** 51]. The influence of humidity and temperature on oviposition and survival of the females is discussed. It is concluded from the author's experiments and from the literature that eggs are not laid if the humidity is much below saturation point. A constant temperature was not necessary for survival. Virgin females oviposited in the laboratory.

Ayroza Galvão (A. L.) & Damasceno (R. G.). *Anopheles* (*Nyssorhynchus*) *konderi* **nova espécie de** *Anopheles* **do Vale do Amazonas e considerações sôbre as espécies do complexo** *tarsimaculatus* **(Diptera, Culicidae).** [*Anopheles konderi*, sp. n., from the Amazon Valley and a Discussion of the Species of the *tarsimaculatus* Complex.]—*Folia clin. biol.* **14** no. 5–6 pp. 115–135, 12 figs., 18 refs. São Paulo, 1942. (With a Summary in English.) [Recd. 1944.]

The authors describe the adult, pupa and fourth-instar larva of *Anopheles* (*Nyssorhynchus*) *konderi*, sp. n., from material collected in the Amazon Valley in November 1941 in a partly shaded, muddy, temporary pool of still water containing erect vegetation and débris at Coarí on the Solimões some 250 miles from Manaos. Material was also collected in similar pools at a place on the Rio Branco, and a muddy, partly shaded backwater at Manaos with floating and erect vegetation. Metatypes were reared from a female taken on a horse at Novo Oriente, São Paulo. The species resembles *A. oswaldoi*, Peryassú, but differs from it in characters of the genitalia.

The authors also review the principal characters of the other members of the *tarsimaculatus* complex to establish the differences between them and *A. konderi*, and revise the nomenclature of the group. The question of the validity of the name *tarsimaculatus*, Goeldi [*cf. R.A.E.*, B **29** 181] is to be submitted to the International Commission on Zoological Nomenclature, and in the meantime the authors adopt it for the form described by Komp as *A. emilianus* [**30** 146, *cf.* also **31** 34 ; **32** 31]. They make no change in the nomenclature of *A. oswaldoi*, Peryassú, *A. rangeli*, Gabaldon, Cova-Garcia & López, *A. nuñeztovari*, Gabaldon, *A. anomalophyllus*, Komp, or *A. goeldii*, Rozeboom & Gabaldon. They accord specific status to *A. oswaldoi noroestensis*, Galvão & Lane, regard *A. oswaldoi ayrozai*, Unti, as a synonym of it, and *A. oswaldoi guarujaensis*, Ramos, as a synonym of *A. tarsimaculatus*, and treat *A. aquasalis*, Curry, provisionally as a variety of *tarsimaculatus*, differing in the egg. They consider that the form identified as *noroestensis* by Galvão [**27** 227] represents an undescribed species, that *A. oswaldoi metcalfi*, Galvão & Lane, is a *nomen nudum* because of insufficient characterisation, and that the Anopheline

identified as the latter by Coutinho [**31** 1] is *A. tarsimaculatus*, unless statistical analysis reveals constant differences in the eggs.

Bruce (C. O.), Knigin (T. D.), Yolles (S. F.) & Graham jr. (A. E.). **Report on Species of *Anopheles* in British Guiana.**—*Amer. J. trop. Med.* **23** no. 4 pp. 437–444, 9 refs. Baltimore, Md., 1943.

In 1941 and 1942, 14 species of *Anopheles* were found at the American Base in British Guiana and another, *A. argyritarsis*, R.-D. [*cf. R.A.E.*, B **27** 229, etc.] was taken in a district distant from the base. *A. albitarsis*, Arrib., which has been reported from the Colony [**27** 229 ; **32** 17], and *A. bellator*, D. & K., which is doubtfully recorded by Simmons & Aitken [**32** 89], were not found during this survey. The characters of the breeding places in which the larvae of eight species were found are analysed. Larvae of *A. nimbus*, Theo., were taken on 174 occasions, mostly in small, protected, jungle pools, but also along the alga-covered margins of running streams, in water with a pH range of 4·4–6·0. Adults were taken far less frequently. Larvae provisionally identified as *A. kompi*, Edw., which had not been definitely recorded from British Guiana, were taken six times in fresh water in sunlit and shady pools and swamps with a pH range of 4·9–5·0. As no males were reared, it was not possible to confirm the identification. *A. darlingi*, Root, the chief vector of malaria [**32** 17], was not taken at the Base site after June 1941, when it almost disappeared from the Colony, probably as a result of three years of drought, but it was re-established in many towns and plantations in October 1942. Larvae from which adults tentatively identified as *A. emilianus*, Komp, were reared were taken in sunny pools of clear fresh water. As eggs were not obtained, the type of breeding place was the main evidence that this was not *A. aquasalis*, Curry, which was probably the brackish water form recorded by Giglioli as *A. tarsimaculatus*, Goeldi [**27** 229]. Larvae of *A. triannulatus*, Neiva & Pinto, were found in small, fresh-water, sunny pools and about 20 adults were also taken. Adults of an unidentified species of *Nyssorhynchus* of the *goeldii* (*tarsimaculatus*) series were plentiful in early June 1942 near houses. *A. oswaldoi*, Peryassú, *A. punctimacula*, D. & K., *A. peryassui*, D. & K., *A. apicimacula*, D. & K., *A. shannoni*, Davis, and *A. intermedius*, Chagas, are recorded from British Guiana, for the first time, the last four on human bait. About 38 collections of larvae of *A. mediopunctatus*, Theo., were made, mostly in small, clear, forest pools with vegetation in partly shaded, protected places with a pH range of 4·4–5·5. Pupae and adults were also taken, the latter on man. Adults and larvae of an undescribed species of the *Arribalzagia* group of the subgenus *Anopheles* were taken in May 1942, and the authors now have all stages and adults of both sexes. The adults attacked man voraciously in the jungle and were present in large numbers in an adjoining village. The preferred breeding places were small, partly-shaded pools of muddy water in abandoned ditches containing rotting vegetation.

Boyd (M. F.) & Russell (J. C.). **Preliminary Observations on the Inheritance of Susceptibility to Malaria Infection as a Character of *Anopheles quadrimaculatus*, Say.**—*Amer. J. trop. Med.* **23** no. 4 pp. 451–457, 1 fig., 7 refs. Baltimore, Md., 1943.

The following is substantially the authors' summary. A line of *Anopheles quadrimaculatus*, Say, was maintained through six generations of brother-sister matings. Females were given the opportunity of engorging on a patient suffering from malaria caused by *Plasmodium vivax* and dissected after oviposition to see whether they had acquired infection. The data do not permit of any conclusion being drawn on the inheritance of susceptibility to the *Plasmodium* [*cf. R.A.E.*, B **19** 249 ; **31** 171 etc.].

Yolles (S. F.) & Knigin (T. D.). **Note on a new transparent Cage for collecting and feeding Mosquitoes.**—*Amer. J. trop. Med.* **23** no. 4 pp. 465–469, 6 figs. Baltimore, Md., 1943.

The cage described consists of a cylinder of transparent celluloid 4½ ins. high, with a metal ointment-box cover 2¾ ins. in diameter over each end. A 1¼-inch square is cut out of each cover and out of two disks of celluloid of corresponding size, and a piece of bobbinette 3½ ins. sq. is stapled between one cover and disk and a diaphragm of two pieces of rubber sheeting, each 3½ ins. sq. with a slit in the centre, between the other cover and disk. The slits are at right angles to each other and permit the insertion of an aspirator of glass tubing ½ in. in diameter. The covers are held in place with copper wire. Detailed instructions are given for the construction of the cage. Its advantages are that it gives an unobstructed view of the mosquitos inside, it is waterproof, small, light, portable, durable and clean, it allows of the feeding of mosquitos in groups and their selective removal, and gives them freedom of movement, and is made of easily obtainable materials. In the field, old X-ray films were used. It has been found successful during four months of constant use at the American Base in British Guiana.

Lewis (E. A.), Wiley (A. J.) & Macaulay (J. W.).—**The Transmission of** *Trypanosoma congolense* **by** *Glossina austeni*.—*Ann. trop. Med. Parasit.* **37** no. 2 pp. 98–107, 10 graphs, 7 refs. Liverpool, 1943.

An account is given of laboratory experiments in which adults of *Glossina austeni*, Newst., bred from pupae collected in the coastal district of Kenya, were infected with *Trypanosoma congolense* and transmitted it to cattle, pigs, rabbits, a sheep, a goat, a dog, a mule, a buffalo and an antelope, usually causing the death of the animal. Details are given of the incubation periods, which were normal, of the reactions of the animals and of the periods during which the trypanosomes were found in their blood. This is the first time that transmission of trypanosomes by *G. austeni* has been proved, though it has been reported to attack cattle readily and to be specially deadly to them in Jubaland. It may, therefore, be regarded as a natural vector of one of the virulent forms of animal trypanosomiasis. At the end of the transmission experiments, the 21 survivors among the flies that had received infective feeds, which had obtained numerous full blood-meals from one or more-heavily infected animals, were dissected and examined for trypanosomes. Immature forms were seen in preparations made from the gut, and in two, the labrum contained dense colonies and the hypopharynx was lightly infested.

Cochrane (E.) & Newbold (C. E.). **Notes on Design and Performance of a flushing Siphon.**—*Ann. trop. Med. Parasit.* **37** no. 2 pp. 108–114, 4 figs., 6 refs. Liverpool, 1943.

As *Anopheles argyritarsis*, R.-D., appeared to be involved in the transmission of malaria in Grenada and its numbers decreased markedly during the rainy season through the washing away of the larvae by flooding [*cf. R.A.E.*, B **31** 185, 186], an attempt was made to reproduce flooding conditions in the dry season (the early months of the year) by means of a flushing siphon based on Macdonald's design [*cf.* **27** 207 ; **31** 217] incorporating the de Villiers siphon [*cf.* **31** 14] in a concrete dam. The site chosen for the first installation was 300 yards above a settlement on the west of the island in a stream less than six feet wide, with a winding rocky bed and many small grassy-edged pools. The valley through which this stream flowed had a population of only about 200 on account

of the malaria that occurred there throughout the dry season. The vector appeared to be *A. argyritarsis*, which has a very short effective range of flight. Macdonald's design was modified in that the passage was wider, the dam was stronger, and the crest of the dam inside the main siphon was sloped so that the first water to pass was shot across the lower limb of the siphon to form a diaphragm and hasten priming. To avoid difficulties encountered in the pipes becoming blocked, the auxiliary siphon, which was outside the main one, was so arranged that the inlet, which was protected by fine screening, was well to the side of the main siphon out of the direct line of suction. Larvae were practically never taken in the 400 yards of stream below the siphon once it worked regularly. Between 400 and 800 yards below it, breeding was markedly decreased although not entirely prevented.

A diagram is given of a siphon proposed for future use and further modified to improve priming, as the auxiliary siphon was found to be of little value for this although it is retained as a vacuum-breaker with the discharge-leg reduced in size. The inlet is made wider and the lower limb is uniformly inclined in order to avoid eddy-formation and to discharge at a better angle.

Sordelli (A.), Manzullo (A.), Riesel (M. A.) & Ferrari (J.). **Tifus exantemático I. La infección experimental de animales de laboratorio con la sangre de enfermos de tifus exantemático de Bs. Aires, Córdoba y Santa Fe.** [Exanthematic Typhus. I. Experimental Infection of Laboratory Animals by Means of the Blood of exanthematic Typhus Patients from Buenos Aires, Córdoba and Santa Fe.]—*Rev. Inst. bact. Carlos Malbran* **11** no. 2 pp. 192–209, 13 diagrs., 10 refs. Buenos Aires, 1942. **II. Virus de las pulgas de ratas de la ciudad de Buenos Aires.** [II. The Virus of Rat Fleas of the City of Buenos Aires.]—*T.c.* no. 3 pp. 272–285, 2 pls., 4 diagrs., 1 map, 2 refs. 1943. **III. Virus de las pulgas y ratas del foco de Ucacha, Pcia. de Córdoba.** [III. The Virus of Fleas and Rats in the Focus of Ucacha, Province of Córdoba.]—*T.c.* pp. 326–348, 2 pls., 2 plans, 24 refs. **IV. Infección *Polyplax* sp. y *Cimex lectularius* con Rickettsiae.** [IV. The Infection of *Polyplax* sp. and *C. lectularius* with Rickettsias.]—*T.c.* no. 4 pp. 381–384, 1 col. pl., 9 refs.

In the first paper, the authors describe investigations on the causal agent of exanthematic typhus in Argentina. Epidemiological and clinical data from cases in Buenos Aires, Córdoba and Santa Fe suggested that the disease was of murine origin, and rickettsiae were obtained from guineapigs and rats infected by inoculation of blood of patients in these cities. In the second and third papers they deal with the infection in fleas and rats in Buenos Aires and at Ucacha in the province of Córdoba, respectively. In Buenos Aires the reactions of guineapigs inoculated with material from white mice that had been inoculated with crushed fleas showed that 6 of 12 batches of *Xenopsylla cheopis*, Roths., taken from rats (*Mus norvegicus*) infesting granaries, were infected with rickettsiae. Seven mild cases of typhus occurred among the 12 inhabitants of a dwelling about 3 miles from the village of Ucacha, and rickettsiae were isolated from two of them. The buildings were infested with *M. norvegicus*, and the *cheopis* index of these rats averaged 11. It is concluded that the disease was murine (endemic) typhus caused by *Rickettsia prowazeki mooseri* and transmitted by *X. cheopis*.

In the fourth paper, it is stated that one of the rats caught in a granary in Buenos Aires was heavily infested with nymphs of *Polyplax* sp. Although fleas from this rat gave negative results, the lice were shown by inoculation into guineapigs to be infected with rickettsiae. Bugs (*Cimex lectularius*, L.) were abundant in the dwelling near Ucacha, and also proved to be infected with rickettsiae.

DEL PONTE (E.). **Estudios sobre el paludismo del Litoral Argentino.** [Studies on Malaria in the Argentine Littoral.]—*Rev. Inst. bact. Carlos Malbran* **11** no. 4 pp. 469–509, 6 pls., 24 refs. Buenos Aires, 1943.

This review of information on malaria in the part of the Argentine Littoral* that comprises the north-east of the province of Corrientes, the north of the province of Sante Fe and the east of the territories of Chaco and Formosa is based on the literature and the author's observations in 1940–42.

Cases of the disease, which is probably endemic in this region, are scattered, and outbreaks usually occur from autumn to spring (April–September) when the temperature falls and rains have formed new breeding places. The Anophelines taken were *Anopheles albitarsis*, Arrib., *A. argyritarsis*, R.-D., *A. triannulatus*, Neiva & Pinto, *A. rondoni*, Neiva & Pinto, *A. mediopunctatus*, Theo., and a species of doubtful identity that differed from *A. triannulatus* and *A. strodei*, Root, only in the male genitalia, for which the author uses the name *tarsimaculatus*, auct. *A. strodei* may also be present. *A. albitarsis* is probably the vector [*R.A.E.*, B **31** 153] as it was present in all outbreak centres and was readily attracted to man, but it appeared to prefer cattle, and the cattle surrounding the farms on summer nights and sheltering in the woods at nightfall in winter form a protective screen against it. Malaria in the region studied is distinct from that in the province of Misiones, where it is epidemic and is apparently transmitted by *A. darlingi*, Root.

TAYLOR (F. H.). **Mosquito Intermediary Hosts of Disease in Australia and New Guinea.**—*Serv. Publ.* (*Sch. publ. Hlth trop. Med.*) *Dep. Hlth Aust.* no. 4, 154 pp., 2 pls., 2 fldg. maps, 73 figs., 2½ pp. refs. Sydney, 1943.

This publication is designed to give as concisely as possible the essential morphology of the larvae, pupae and adults of the species of mosquitos that are or may be concerned in the transmission of malaria, dengue and *Filaria* (*Wuchereria*) *bancrofti* in Australia and New Guinea or that might transmit yellow fever or *F.* (*W.*) *malayi* if these were introduced. It also deals with the control of the mosquitos. Much of the information is quoted from other works.

A general account of the morphology of Anophelines is followed by a description of the characters used in identification and classification and notes on the latter. The system followed as regards genera and subgenera is that of Edwards. There is a general survey of Anopheline bionomics in relation to disease. Keys are given to the adults, pupae and larvae of the tribes of the subfamily CULICINAE and the adults and larvae of the subgenera of *Anopheles* and the species dealt with, and systematic descriptions of the subfamily, the tribe ANOPHELINI, the genus *Anopheles*, the subgenera *Anopheles* and *Myzomyia* and the species of the region that transmit malaria or *F. bancrofti*. Notes are included on the distribution of these species and their relation to disease and in some cases their breeding places and feeding habits. The tribe CULICINI, the genera *Mansonia* (*Taeniorhynchus*), *Aëdes* and *Culex*, subgenera of the first two and species of actual or potential importance in relation to filariasis, dengue and yellow fever are similarly dealt with. The information on the genus *Aëdes*, the subgenus *Stegomyia* and the species of this subgenus, including notes on control, is the same as that given in the second part of a publication on dengue [*R.A.E.*, B **32** 82].

The later sections deal with the collection of material in the field, feeding habits and maxillary indices of Anophelines, the determination of the intermediary hosts of malaria by the index of experimental infection and the index of

* The region called the Argentine Littoral is not, as might be assumed from its name and a recent abstract [*R.A.E.*, B **31** 153], a purely coastal zone, but comprises the provinces of Buenos Aires, Entre Rios, Santa Fe and Corrientes and the territories of the Chaco, Formosa and Misiones.—*Ed.*

natural infection, the object and technique of dissection, endemic areas of malaria and Anopheline distribution in Australia, the range of flight of Anophelines, the disappearance of malaria from Britain, means of obtaining protection from mosquito bites and of destroying adult mosquitos, measures against the larvae, and the mounting and care of collections and preparation of specimens for identification.

Das (B. K.). **Malaria at Chandpur (Bengal).**—*Indian med. Gaz.* **78** no. 7 pp. 327–330, 1 graph, 4 refs. Calcutta, 1943.

An epidemic of malaria broke out in July 1942 at Chandpur, on the bank of the river Meghna in eastern Bengal. The incidence of new cases reached its peak in August. Very heavy rainfall during 1941, which prevented the drying up of many breeding places during summer and resulted in continuous mosquito breeding, a large number of evacuees passing through from Burma, and low rainfall associated with low tide water in 1942 preventing the flooding of breeding places are considered to be factors that probably contributed to the epidemic. A survey of a labour colony between the Meghna and another river and somewhat isolated from the town was made between 29th October and 2nd November and showed a high percentage of infection and a very high gametocyte rate (59 per cent.) typical of epidemic conditions in an area of low endemicity. Larvae of *Anopheles aconitus*, Dön., *A. annularis*, Wulp, *A. vagus*, Dön., *A. pallidus*, Theo., and *A. hyrcanus*, Pall., were found in reservoirs and borrow-pits, and adults of the first three were taken in houses. No infection was found in 66 females of *A. annularis*, but 2 out of 24 females of *A. aconitus* were positive, one having gut and one both gut and gland infection. *A. aconitus* had not previously been considered an important vector in this part of India. Of 30 adults of this species taken, 25 were from houses, where it accounted for 27 per cent. of the total females, and 5 were from slit trenches lined with brick and having a roof of bamboo matting and grass with a gap below it. Larvae were found chiefly among the roots of water hyacinth [*Eichhornia*]. The large area covered by reservoirs, borrow-pits and marshes with a heavy growth of weeds, and the masses of water hyacinth that float down the rivers probably carrying larvae and pupae, make anti-larval measures seem impracticable.

Senior White (R.). **Effect of Reduction of Surface Tension on Mosquito Pupae.**—*Indian med. Gaz.* **78** no. 7 p. 342. Calcutta, 1943.

In experiments on the effect on pupae of *Aëdes aegypti*, L. (*Stegomyia fasciata*, F.) of reducing the surface tension of the water in the breeding place by the addition of soap [*cf. R.A.E.*, B **30** 188], pupae did not die in solutions containing less than one part saturated soap solution per 600 parts double distilled water or per 300 parts tap water. In solutions of this strength, they died in 100 and 180 minutes, respectively, and pupae of *Culex fatigans*, Wied., died in the latter solution, but after a much longer time. Death apparently occurred during emergence. Larvae of *A. aegypti* died in 165 minutes in a 1 : 50 solution in tap water. The method is not applicable with very hard water as the soap is thrown out of solution at once.

Rodhain (J.) & van Hoof (M. T.). **Recherches sur l'anophélisme en Belgique.**—*Ann. Soc. belge Méd. trop.* **22** no. 1 pp. 19–42, 1 map, 25 refs. Brussels, 1942. (With a Summary in Flemish.) [Recd. 1944.]

Malaria disappeared from Belgium over 50 years ago. The literature on its occurrence there in the nineteenth century is reviewed, and the decline in its incidence, which is shown to have set in in 1863, is attributed to drainage, increase in stock, stimulation of agriculture and treatment with quinine. It is

not possible to assess the effect of the drainage on Anopheline populations as the first available information on the Belgian species of *Anopheles* dates from 1910, when M. Goetghebuer recorded the occurrence of *A. maculipennis*, Mg., and *A. claviger*, Mg. (*bifurcatus*, auct.) and their distribution [*cf.* also *R.A.E.*, B **13** 168]. The discovery of two biotypes of *A. maculipennis*, var. *atroparvus*, van Thiel, and var. *messeae*, Flni., is recapitulated, the differences in morphology and habits are outlined and their distribution in Belgium is discussed. This was determined chiefly by rearing adults from material taken in various localities and observing whether they reproduced in cages (*atroparvus*) or did not (*messeae* [*cf.* **28** 85]). The investigations were begun at the end of September 1937. The presence of *messeae* was definitely proved only once, but *atroparvus* was more widely distributed than was previously supposed, and occurred even in completely fresh water. However, it was comparatively scarce except in two localities where the salinity of water in ditches reached or exceeded 2·5 parts per mille and it was as abundant as in parts of Holland where malaria is still endemic.

Schwetz (J.), Baumann (H.), Beumer (Mme) & Fort (M.). **Sur le paludisme endémique constaté dans six agglomérations indigènes du Bas-Lomami (Congo Belge).**—*Ann. Soc. belge Méd. trop.* **22** no. 1 pp. 45–70, 1 map, 2 refs. Brussels, 1942. (With a Summary in Flemish.) [Recd. 1944.]

The results are given of a malaria survey made in 1939 in six villages on the banks of the lower Lomami and one of its tributaries in the Belgian Congo. Of the 472 children and 340 adults examined, 418 and 132, respectively, showed malaria parasites and 247 and 53 showed gametocytes. The percentage of children with parasites in the various villages varied from 85 to 94·1 and of adults from 20 to 46·6. The only Anopheline found in considerable numbers was *Anopheles gambiae*, Giles, but a few individuals of *A. funestus*, Giles, and *A. marshalli* var. *moucheti*, Evans, were taken.

There was a high percentage of infestation with microfilariae. *Filaria perstans* and *F. loa* were both present, but the former was much the commoner. Records of the occurrence of *Simulium* spp. and *Culicoides grahami*, Aust., are cited from a previous survey [*R.A.E.*, B **19** 82].

Schwetz (J.). **Recherches sur la limite altimétrique du paludisme dans le Congo Oriental et sur la cause de cette limite.**—*Ann. Soc. belge Méd. trop.* **22** no. 3 pp. 183–208, 8 refs. Brussels, 1942. (With a Summary in Flemish.) [Recd. 1944.]

The object of this study was to define the altitude at which malaria ceases to be endemic in Africa and to ascertain the reason for its absence from the high regions. Data from parts of Africa other than the Belgian Congo are reviewed. They indicate a limit between about 5,000 and 6,500 ft. Observations made in the eastern Congo in 1933 and 1939 showed that the limit there fell between 5,500 and 5,850 ft. This was also found to correspond with the upper limit of distribution of *Anopheles gambiae*, Giles, *A. funestus*, Giles, and the species often found with them at lower altitudes and generally with the lower limit of *A. christyi*, Newst. & Cart. [*cf. R.A.E.*, B **30** 179] and *A. kingi*, Christ. The lowest point at which *A. christyi* was found was on Lake Kivu at 4,745 ft. where it occurred with *A. gambiae*. The cause of the absence of malaria from the high parts of Eritrea and Abyssinia is discussed from the data in the works of Italian authors. It is thought to be either the absence of vector

species of *Anopheles* [*cf.* **26** 67, 183 ; **28** 62] or the inability of the parasite to develop in the mosquito on account of the cold.

HIGHBY (P. R.). **Mosquito Vectors and Larval Development of *Dipetalonema arbuta* Highby (Nematoda) from the Porcupine, *Erethizon dorsatum*.**—*J. Parasit.* **29** no. 4 pp. 243–252, 15 figs., 21 refs. Lancaster, Pa., 1943.

The following is based on the author's summary. Porcupines from northern Minnesota were found to be commonly infected with *Filaria* (*Dipetalonema*) *arbuta* and *F.* (*Dirofilaria*) *spinosa*. The microfilariae of these two species could be distinguished from each other by three anatomical characters. No natural infection was found in 340 mosquitos of selected species from the neighbourhood of Minneapolis and St. Paul, but *Aëdes canadensis*, Theo., *A. cinereus*, Mg., *A. fitchi*, Felt & Young, *A. stimulans*, Wlk., *A. vexans*, Mg., and *Mansonia* (*Taeniorhynchus*) *perturbans*, Wlk., which occur in Minnesota, and *A. aegypti*, L., which does not, supported the complete larval development of *F. arbuta*. However, marked resistance to the development of the parasite, correlated with its pigmented encapsulation, was observed in *A. vexans*. Pigmented encapsulation was noted to have occurred on a living worm. Voluntary emergence of the infective larvae from the labium of *A. aegypti*, *A. canadensis*, *A. cinereus* and *A. fitchi*, the only species tried, was induced by immersion of the labella in fresh warm porcupine serum without pressure. No correlation was found between the rate of infection in experimental mosquitos and the degree of parasitism in the porcupines that served as the source of infection. The site of development was in the fat-body, hitherto unreported for filarioids in mosquitos. The larval development of *F. arbuta* is fundamentally similar to that described for other filarioids.

HIGHBY (P. R.). **Vectors, Transmission, Development, and Incidence of *Dirofilaria scapiceps* (Leidy, 1886) (Nematoda) from the Snowshoe Hare in Minnesota.**—*J. Parasit.* **29** no. 4 pp. 253–259, 1 fig., 19 refs. Lancaster, Pa., 1943.

The following is almost entirely based on the author's summary. Microfilariae were recovered from the blood in the gut of an engorged tick removed from the ear of a snowshoe hare (*Lepus americanus phaeonotus*) caught in northern Minnesota, and 8 adult females and 7 adult males of *Filaria* (*Dirofilaria*) *scapiceps* were subsequently recovered from the hare. In experiments with local mosquitos fed on it, *Aëdes canadensis*, Theo., *A. cinereus*, Mg., *A. excrucians*, Wlk., *A. fitchi*, Felt & Young, and *A. vexans*, Mg., were shown to support the complete larval development of the parasite. It was transmitted from the hare to a domestic rabbit by mechanical transfer of the infective-stage larvae from experimentally infected mosquitos to the scarified skin of the rabbit, and an adult was recovered from the rabbit 240 days later. *A. fitchi* and *A. cinereus* transmitted it from the hare to two domestic rabbits by biting, and microfilariae were demonstrated in the blood of the rabbits 286 and 391 days after exposure, respectively. Infection was detected as frequently by examination of the labium of the living mosquito as by dissection. The larval stages of *F. scapiceps* are largely similar to those of other filarioids. Microfilariae may escape from the sheath in the body cavity of the mosquito. The first and second larval stages were found in the fat-body. The earliest noted appearance of the third larval stage was on the eleventh day of incubation in the mosquito. The microfilaria is described and illustrated. The snowshoe hare is commonly infected throughout its range in Minnesota. Incidence rates of the filaria varied from 13 to 58 per cent. of hares examined from three geographic extremes of this range in 1938–39. Xenodiagnosis of filariasis by ticks and mosquitos was useful.

Doner (M. H.) & Thomssen (E. G.). **Cockroaches and their Control.**—*Soap* **19** no. 9 pp. 94–97, 113, 1 fig., 20 refs. New York, N.Y., 1943.

At least 40 species of cockroaches occur in America north of Mexico. A key is given to the adults of the eight species considered of economic importance, and also a short, general account of the bionomics of these insects. The part that they play in the transmission of diseases of man and parasitic worms of poultry, the ways in which they enter houses and the effect of insecticides on them are discussed, largely from the literature, and various control measures are reviewed. These are cleanliness, blocking of cracks, the use of baited traps, insecticidal sprays and dusts and phosphorus pastes and fumigation by a professional operator. Reference is also made to substitutes for pyrethrum and sodium fluoride and to infra-red irradiation [*R.A.E.*, A **30** 360].

McGovran (E. R.), Fales (J. H.) & Goodhue (L. D.). **Testing Aerosols against Houseflies.**—*Soap* **19** no. 9 pp. 99, 101, 103, 105, 107, 4 figs., 5 refs. New York, N.Y., 1943.

Commercial production of a solution of pyrethrum extract and sesame oil in dichlorodifluoromethane for use as an aerosol [*R.A.E.*, B **31** 167] has given rise to a need for standardised testing procedure. This paper deals with methods of handling the solution in biological tests and preliminary data obtained in experiments against *Musca domestica*, L. The materials and equipment used are described. Containers with a capacity of about 500 cc. were convenient for experimental samples. Before being sprayed, solutions were transferred to a special dispenser with a graduated glass tube so that dosage could be more accurately controlled. The methods of preparing the solution in the container and of filling the dispenser are described, and curves showing the corrections to be applied in preparing and dispensing the solutions are given.

Dosages of 0·5–2 gm. solution containing 5 per cent. pyrethrum extract (19 per cent. total pyrethrins) and 2 per cent. sesame oil sprayed into a cubic Peet-Grady chamber with sides 6 ft. long at a temperature of 85°F. caused a degree of mortality among adults of *M. domestica* 3–5 days old suitable for the comparison of the toxicity of aerosols. A dosage of 1 gm. gave the nearest mortality to 50 per cent. and was the most frequently used. An exposure of 15 minutes was satisfactory. Dosages of 0·5 and 2 gm. caused most knockdown in the second and first periods of 5 minutes following spraying, respectively, and 1 gm. gave approximately equal knockdown in the two periods. The rate of knockdown decreased after 10 minutes. In the range of dilution tested, the solutions containing the highest concentrations of non-volatile material were the most toxic when equal quantities of non-volatile material were applied, and formed the aerosols that settled most rapidly. Sesame oil increased the toxicity of pyrethrum aerosols to *M. domestica* much more than refined cottonseed oil, and medicinal-grade mineral oil appeared more effective than deodorised kerosene. A higher mortality was caused by aerosols dispersed through capillary tubes 2 inches long with 0·017-inch and 0·03-inch bores than through an oil-burner nozzle with an orifice 0·01 inch in diameter, which had been used in all the earlier tests. No difference in settling rate was detected. A longer tube also gave the same settling rate, but a slower rate of delivery and rather inferior results. A comparison of several pyrethrum-kerosene aerosols showed that significantly different mortalities can be obtained with aerosols differing by 0·15 per cent. in pyrethrin content.

Campbell (F. L.) & Moulton (F. R.). Ed. **Laboratory Procedures in Studies of the Chemical Control of Insects.**—*Publ. Amer. Ass. Advanc. Sci.* no. 20, viii+206 pp., 62 figs., 12 pp. refs. Washington, D.C., 1943.

The basic plan of this symposium on the methods of rearing test insects and of testing insecticides and the papers it comprises have been noticed elsewhere

[*R.A.E.*, A **32** 168]. The papers that deal particularly with Arthropods of medical and veterinary importance are: Rearing Insects affecting Man and Animals, by E. N. Woodbury (pp. 60–73), supplemented by notes on the house-fly (*Musca domestica*, L.), by E. Bickoff (p. 74), the house-fly and the stable fly (*Stomoxys calcitrans*, L.), by C. Eagleson (pp. 74–78), ticks, by C. N. Smith & M. M. Cole (pp. 78–80), and dog and cat fleas (*Ctenocephalides canis*, Curt., and *C. felis*, Bch.), by C. E. Venard (pp. 80–81); Testing Contact Insecticides, by C. H. Richardson (pp. 126–135), and a supplementary note on livestock sprays by C. Eagleson (pp. 136–138); Making and testing Aerosols, by L. D. Goodhue & W. N. Sullivan (pp. 157–162); and a note on the evaluation of blowfly repellents, by E. S. Loeffler & W. M. Hoskins (p. 173), which supplements a paper by V. G. Dethier on Testing Attractants and Repellents (pp. 167–172).

Munro (J. A.) & Telford (H. S.). **Winter Control of Cattle Lice.**—*Bull. N. Dak. agric. Exp. Sta.* no. 324, 11 pp., 5 figs. Fargo, N. Dak., 1943.

Brief notes are given on the morphology and bionomics of *Haematopinus eurysternus*, Nitzsch, *Linognathus vituli*, L., and *Damalinia* (*Bovicola*) *bovis*, L., the lice that commonly infest cattle in North Dakota. A fourth species, *Solenopotes capillatus*, End., is occasionally found. Infestation is heaviest in the winter. A survey of 550 animals made in 1942–43 showed that those that are kept indoors are most affected. *H. eurysternus* was the predominant louse, and not more than one species was usually found on one host. The most satisfactory control measure is dipping in early autumn, but when this has been impracticable, the cattle should be dusted. As rotenone and pyrethrum are scarce, tests were made of the effectiveness of dusts of nicotine, naphthalene, paradichlorbenzene, sabadilla seed, thanite, phenothiazine and sodium fluosilicate, diluted with dusting sulphur, wheat flour or bentonite. A sulphur dust containing not more than 1 per cent. nicotine proved the most satisfactory, killing the lice within 5 minutes. When bentonite was substituted for sulphur, the effect was equally thorough but slower. As little as 0·25 per cent. nicotine in sulphur gave excellent results. If nicotine is not available, a mixture of 2 parts sodium fluoride or sodium fluosilicate, 1 part phenothiazine and 5 parts diluent will kill both biting and sucking lice [*cf. R.A.E.*, B **31** 173]. Dusts should be applied at intervals of 3–4 weeks and thoroughly rubbed in. Precautions to be taken in using nicotine are mentioned.

Steiner (G.). **Untersuchungen über die Kältewiderstandsfähigkeit der Eier und Larven von Fleischfliegen.** [Resistance to Cold of Eggs and Larvae of Blowflies.]—*Anz. Schädlingsk.* **17** p. 133. (Abstract in *Vet. Bull.* **13** no. 10 p. 358, Weybridge, 1943, from abstract in *Z. Fleisch- u. Milchhyg.* **52** p. 232.)

Eggs of *Phormia regina*, Mg., were able to develop after 12 days at temperatures of 2·5 to 4·5°C. [36·5 to 40·1°F.], 8 days at −3·5 to 0°C. [25·7 to 32°F.], two days at −6°C. [21·2°F.] or three hours at −24 to −18°C. [−11·2 to −0·4°F.]. Young larvae were equally resistant to cold except at the very low temperatures, when they were more easily killed than the eggs. Of well developed larvae, 50 per cent. were alive after 70 days at 5°C. [41°F.], 30 per cent. after 55 days at 2°C. [35·6°F.], 20 per cent. after 35 days at −0·5°C. [31·1°F.], 5–10 per cent. after 10–20 days at −2°C. [28·4°F.] and 2–5 per cent. after 4–10 hours at −8·5°C. [16·7°F.]. The longest survival time at −15°C. [5°F.] and below was two hours. *Lucilia caesar*, L., did not survive so long as *P. regina*. It is concluded that normal cold storage conditions will not necessarily kill blowflies, and the implications of this in relation to problems of supply in the army are discussed.

PORTER (D. A.). **Some new intermediate Hosts of the Swine Stomach Worms,** *Ascarops strongylina* **and** *Physocephalus sexalatus*.—*Proc. helminth. Soc. Wash.* **6** no. 2 pp. 79–80. Washington, D.C., 1939. [Recd. 1944.]

Alicata (Tech. Bull. U.S. Dep. Agric. no. 489 1935 pp. 1–96) records *Aphodius rufus*, Moll (*castaneus*, Marsh.), *A. granarius*, L., *Gymnopleurus* sp., *Popilius disjunctus*, Ill. (*Passalus cornutus*, F.) and *Scarabaeus* sp. as intermediate hosts of *Ascarops strongylina*, and *Ataenius cognatus*, Lec., *Canthon pilularius*, L. (*laevis*, Dru.), *Geotrupes douei*, Gory, *G. stercorarius*, L., *G.* (?) *stercorosus*, Scriba, *Gymnopleurus sturmi*, Macleay, *G. sinuatus*, Ol., *Onthophagus bedeli*, Rttr., *O. hecate*, Panz., *O. nebulosus*, Reiche, *Popilius disjunctus* (*Passalus cornutus*), *Phanaeus carnifex*, L. (*vindex*, Macleay), *Scarabaeus sacer*, L., and *S. variolosus*, F., as intermediate hosts of *Physocephalus sexalatus*. To ascertain whether other beetles are also intermediate hosts of these Nematodes, the author examined dung beetles taken in 1937 from ground in Georgia where hogs were kept. The results showed that all of 20 adults of *Phanaeus carnifex*, 4 of 7 of *Copris minutus*, Dru., and each of 4 of *Canthon pilularius* were infested with larvae of *Physocephalus sexalatus*, and 27 of 145 of *Aphodius lividus*, Ol., and 16 of 122 of an unidentified species of *Aphodius* with those of *Ascarops strongylina*. The two species of *Aphodius* were abundant in contaminated pastures and migrated to manure within 24 hours after it was deposited on a clean pasture. Not more than 4 larvae of *Ascarops strongylina* were found in a beetle, but the large numbers of beetles present would ensure infestation of pigs feeding there. The intermediate hosts of *P. sexalatus* were less common and, except for *Phanaeus carnifex*, which averaged 300 larvae encysted in the body cavity, they contained only a few larvae each. A young parasite-free pig was found to contain over 250 individuals of *Physocephalus sexalatus* 9 days after ingesting 550 encysted larvae taken from two individuals of *Phanaeus carnifex*, indicating the importance of this host in infestation.

MORGAN (B. B.). **The Viability of** *Trichomonas foetus* **(Protozoa) in the House Fly** (*Musca domestica*).—*Proc. helminth. Soc. Wash.* **9** no. 1 pp. 17–20, 12 refs. Washington, D.C., 1942. [Recd. 1944.]

Various workers have found that *Trichomonas* spp. and related flagellates can survive in *Musca domestica*, L., and other flies [*cf. R.A.E.*, B **5** 117; **25** 277], and since infection of virgin heifers with *T. foetus*, recorded in 1936, shows that it can sometimes be transmitted non-venereally, investigations were carried out in Wisconsin to ascertain whether *M. domestica* is a possible vector of this flagellate. The flies used were kept without food for 18–21 hours after emergence, and were then allowed to feed on about 0·1 cc. of a mixture of equal parts of whole milk, distilled water and the liquid portion of a bacteria-free culture of *T. foetus* with a count of approximately two million organisms per cc., with enough carmine to colour it. The fluid containing the trichomonads was composed of a buffered saline-citrate solution with 5 per cent. bovine serum. After feeding, the flies were transferred singly to clean test tubes, and in the first experiment 200 were dissected in batches of five at intervals of 30 minutes. The results showed that *T. foetus* was recovered from the digestive tract for ½–16½ hours after ingestion. Trichomonads were re-isolated after migration in a culture medium, indicating that they might still be able to set up an infection. In the second experiment, the vomit of 100 flies, examined 1–5 minutes after feeding, was positive for motile *T. foetus*. The flies usually began to excrete pink faecal material 2½–3½ hours after feeding, and motile trichomonads were observed in the excreta 2½–6 hours after ingestion. When the flies were allowed to feed on milk about 3 hours after the infecting feed, motile trichomonads were found in the excreta for up to 8 hours after they had been ingested. When motile trichomonads were no longer found

in the excreta, they could in some cases be observed in the intestine. Re-isolation from the excreta 2, 4 and 5½ hours after ingestion showed the organism to be still infective. In all experiments, the controls were negative. It is concluded, therefore, that *M. domestica* might transmit *T. foetus* to cattle by defecating or regurgitating on the genitalia.

ANDREWS (J. S.), TAYLOR (A. L.) & SWANSON (L. E.). **Fumigation of Soil with Methyl Bromide as a means of destroying infective Stages and intermediate Hosts of some internal Parasites of Mammals.**—*Proc. helminth. Soc. Wash.* **10** no. 1 pp. 4–6, 4 refs. Washington, D.C., 1943.

In the experiment described, eggs of four Nematodes and oöcysts of coccidia parasitic in pigs, together with dung beetles and earthworms, which are the intermediate hosts of Spirurid stomach worms and lungworms, respectively, were transferred to glass containers, which were closed with gauze and placed on the surface of the ground and 2, 6 and 12 ins. below it in plots of newly ploughed sandy loam soil 8 ft. square. The plots were covered with gas-proof paper, and the contents of a 1 lb. can of methyl bromide released beneath each cover. Examination 20 hours later revealed no signs of life in any of the treated organisms, whereas most of those in the control plot were viable.

LEVER (R. J. A. W.). **Entomological Notes.**—*Agric. J. Fiji* **14** no. 3 pp. 77–83, 22 refs. Suva, 1943.

There was a fairly heavy outbreak of dengue in Suva in May and June 1943. The disease occurred in Fiji in 1885 and again in 1908, when it was apparently introduced from Queensland ; records of its distribution in other islands in the Pacific are cited from a recent publication [*R.A.E.*, B **32** 82], and notes are given on the breeding places of *Aëdes aegypti*, L., the vector. An experiment in the New Hebrides showed that *Anopheles punctulatus*, Dön., could develop in samples of water from Suva [*cf.* **31** 131]. Larvae of *Aëdes scutellaris pseudoscutellaris*, Theo., and *Culex fatigans*, Wied., from Suva were reared to the adult stage in water from two rivers on the northern coast of Guadalcanal having pH values of 7·31 and 5·57, respectively, and 1·1 and 0·8 parts chlorides per 100,000, but all died in the water of a third river that had a pH of 7·07 and 1,880·0 parts chlorides per 100,000. Nitrates were not a factor. Notes are given on the breeding places of a number of other Culicine larvae. Normal adults of *C. annulirostris*, Skuse, were reared from young larvae placed in brackish water that would have repelled ovipositing females of this species in nature. A dust containing 1 per cent. Paris green failed to control *C. fatigans* in a slowly flowing stream, and one containing 2 per cent. did not give a complete kill.

RUSSELL (P. F.), ROZEBOOM (L. E.) & STONE (A.). **Keys to the Anopheline Mosquitoes of the World with Notes on their Identification, Distribution, Biology, and Relation to Malaria.**—152 pp., 10 figs., 5 pp. refs. Philadelphia, Pa., Amer. ent. Soc., 1943.

The Anophelines of the world are dealt with under geographical regions, each section comprising keys to the adult females and fourth-instar larvae of the species about which sufficient data are available, followed by an annotated list of the species. A key is also given to the eggs of the European members of the complex of *Anopheles maculipennis*, Mg., for which the nomenclature of Bates [*R.A.E.*, B **29** 41] is adopted. A list of the important vectors of malaria, arranged geographically and showing authorities, is appended.

Watson (Sir M.). **The geographical Aspects of Malaria.**—*Geogr. J.* **99** no. 4 pp. 161–172, 1 graph, 1 map. London, 1942. (Also in *Rep. Smithson. Instn 1942* pp. 339–350, 1 graph, 1 map, 15 refs. Washington, D.C., 1943.)

A review, based largely on the author's personal experience during the last 30 years, is given of the ways in which malaria has been controlled in various parts of the world by measures, differing in the individual areas, that prevent the breeding of the particular species or races of *Anopheles* that are the important or sole vectors and usually represent only a small proportion of the total number of Anophelines present.

DeSanctis (A. G.) & di Sant'Agnese (P. A.). **Tick Paralysis (Report of a Case in New York).**—*J. Amer. med. Ass.* **122** no. 2 pp. 86–88, 8 refs. Chicago, Ill., 1943.

The characteristics of tick paralysis are given. It occurs frequently in man and domestic animals in the north-western United States and Canada [*cf. R.A.E.*, B **25** 178; **32** 80], where it is due to *Dermacentor andersoni*, Stiles. Reference is made to records of three cases that occurred in South Carolina in 1938 and Georgia in 1938 and 1940 and were all caused by *D. variabilis*, Say. A passage is quoted from one of the papers to the effect that the condition is so familiar to the negroes of southern Georgia that they immediately search for ticks on children or domestic animals that show the characteristic signs. An account is then given of a case that occurred in 1942 in New York and is thought to be the first to be recorded from the north-eastern United States. There was no increase in the severity of the condition after the first 24 hours, and recovery was rapid and complete following the removal of a partly engorged pregnant female of *D. variabilis* by simple traction from the child's head, on the tenth day after the onset of symptoms. It is suggested that the syndrome caused by *D. variabilis* may be milder than that caused by *D. andersoni*.

Davis (G. E.). **Experimental Transmission of the Spotted Fevers of the United States, Colombia, and Brazil by the Argasid Tick** *Ornithodoros parkeri*.—*Publ. Hlth Rep.* **58** no. 32 pp. 1201–1208, 3 figs., 5 refs. Washington, D.C., 1943.

The following is based on the author's discussion and summary. *Ornithodoros parkeri*, Cooley, occurs in nine of the western States in which Rocky Mountain spotted fever is endemic [*cf. R.A.E.*, B **28** 28; **30** 89; **31** 138], but is not known in Colombia or Brazil. It has many hosts in common with *Dermacentor andersoni*, Stiles, the usual vector of Rocky Mountain spotted fever to man. An account is given of experiments in which the infection was transmitted by larvae, all the nymphal stages and adults of both sexes and by the progeny of infected females to the fourth generation [*cf.* **31** 41]. One female was infective 994 days after the infective feed in the second nymphal stage. In the experiment, the interval between the infective feed and the fourth test feed in the F_4 generation was 1,333 days, and the invasiveness of the infective agent did not weaken over this period. The Colombian and Brazilian spotted fevers were transmitted as regularly as the spotted fever of the United States. The Colombian infection was transmitted through the egg to the F_2 generation and the Brazilian to the F_1 generation. Some females that failed in transmission gave rise to infective eggs and progeny. Ticks that had fasted for a year produced typical infection, and their progeny produced infections resulting in the death of the host. The data suggest that *O. parkeri* may be a factor in the maintenance of spotted fever in nature and, occasionally at least, a vector to man.

Dreyfus (A.) & Breuer (M. E.). **Chromosomes and Sex Determination in the parasitic Hymenopteron** *Telenomus fariai* (**Lima**).—*Genetics* **29** no. 1 pp. 75–82, 37 figs., 14 refs. Menasha, Wis., 1944.

Investigations on the biology of the Scelionid, *Telenomus fariai*, Costa Lima, a parasite of the eggs of *Panstrongylus* (*Triatoma*) *megistus*, Burm. [*cf. R.A.E.*, B **15** 235 ; **17** 53], have shown that a fertilised female lays 7–8 eggs in a single egg of the host and that its offspring are females and small males, with a preponderance of the former. The parasites pair before they emerge from the host egg, and one male can fertilise most or all of the females in it. To obtain virgins for experiments it is necessary to break the host egg shell and isolate the females immediately they emerge from the pupae. Virgin females produce large male larvae only. Male larvae grow more slowly than do female larvae, but the opposite occurs in the pupal stage, so that the males emerge from the pupae inside the host egg sooner than the females.

The chromosome number is 20 in females and 10 in males, regardless of their origin. The small size of the male offspring of fertilised females is due to the slowly developing male larvae suffering from competition with the female larvae for food. Details are given of an unusual chromosome mechanism that operates during spermatogenesis and prevents the production, as a consequence of the sibling mating characteristic of the species, of diploid homozygotes. These, by analogy with other parasitic Hymenoptera, would be males of reduced viability useless to the species.

Blackstock (E.). **Treatment of Pediculosis capitis.**—*Brit. med. J.* no. 4333 pp. 114–115. London, 1944.

The percentages of children in elementary schools in a large town in the north-west of England found during routine inspection to be infested with *Pediculus humanus capitis*, Deg., rose from 13·9 in 1938 to 20·17 in the first half of 1943. The author found lethane oil [12·5 per cent. N-butyl carbitol thiocyanate, 37·5 per cent. beta-thiocyanoethyl laurate and 50 per cent. refined paraffin (*R.A.E.*, B **30** 99 ; **31** 205)] excellent for the control of the lice, but unsatisfactory with regard to the eggs as it left them cemented to the hair [*cf.* also **31** 206]. Ascabiol (benzyl benzoate emulsion emulsified with triethanolamine stearate) loosened the eggs so that they could be removed by washing with soap and water and was non-irritant even if used twice daily for three or four days. Neither the benzyl benzoate dissolved in spirit nor the emulsifier alone loosened the eggs. The routine treatment is to paint the head with the emulsion, wash it with soap and water the next day and inspect for possible reinfestation a week later. In cases of very heavy infestation, treatment is carried out twice in 24 hours, and if there is coincident coccal infection, it is carried out on three successive days and a healing ointment is then applied.

Papers noticed by Title only.

De Meillon (B.). **Simuliidae and Ceratopogonidae (Dipt. Nematocera) from the Colony of Moçambique** [including 5 new Ceratopogonids].—27 pp., 4 pls. Lourenço Marques, Estaç. anti-malár., 1943. [Translation : see *R.A.E.*, B **31** 168.]

Jachowski jr. (L.). **The Oriental Rat Flea** (*Xenopsylla cheopis*) [on *Mus* (*Rattus*) *norvegicus*, recorded for the first time] **in Michigan.**—*J. Parasit.* **29** no. 4 p. 300. Lancaster, Pa., 1943.

Nájera Angulo (L.). **Una técnica nueva para aislamiento y montaje de pequeños acarianos parásitos de los animales.** [A new Technique for Separating and Mounting small Acarine Parasites of Animals.]—*Bol. Soc. esp. Hist. nat.* **41** no. 7–8 pp. 375–377, 1 fig. Madrid, 1943.

MILNE (A.). **The Comparison of Sheep-tick Populations** (*Ixodes ricinus* **L.**).—*Ann. appl. Biol.* **30** no. 3 pp. 240–250, 24 refs. London, 1943.

The following is the author's summary. Experiments in sheep-tick control require the comparison of tick counts on sheep pastured on an infested grazing or on a blanket dragged over the grazing. The former should include only attached females on axillae, forearms, head, neck and chest. The distribution of tick counts on a group of sheep is in general not fitted by the normal distribution, nor, although it is positively skewed, by the Poisson. There is evidence that the distribution could be derived from a population distributed according to a negative binomial. Unless the data are more than ordinarily skewed (in which case a " normalizing " square-root transformation may be necessary), the best available method for comparing mean tick counts on sheep is the direct *t*-test using actual tick numbers. Within the range 0·3-103·7 ticks per sheep, the regression of standard deviations on means is linear and was calculated as $s=0{\cdot}477\bar{x}+1{\cdot}246$.

For estimating the significance of small differences between dips or ground population densities, tick counts on groups of five sheep are inadequate. Groups of 20 or more sheep should be employed according to the magnitude of the difference required to be proved significant. For showing the trend, only, of tick activity throughout a season on a particular section of land, weekly counts on 10 sheep are adequate provided that the same 10 sheep are always used. The sources of the large variation in the tick counts of individual sheep are pointed out, with suggestions as to how this variation may be reduced.

In blanket dragging, counts of nymphs are best for estimating population densities. Drags may be limited to 25 yards. A differential equation is given whereby the nymphs lost in the course of a drag are taken into account. This does not surmount the difficulty that uniformity of vegetation surface influences the efficiency of the blanket, which should therefore be used for comparisons only when the vegetation surfaces are of similar uniformity. A worn blanket picks up fewer ticks than a less worn blanket. The distribution of nymphal blanket counts is similar to that of female tick counts on sheep in that it is not in agreement with the Poisson law although positively skewed. It is in closer, though far from satisfactory, agreement with a " contagious " distribution. Because of the effect of changing meteorological conditions on tick activity, the densities of tick population (tick activities) on different plots must be compared by dragging the plots simultaneously. A virgin stretch of ground is necessary for each drag in each season. In such comparisons, the precision can more easily be increased by increasing the number of " occasions " (days) of simultaneous draggings than by increasing the number of drags per " occasion." Two, or three, drags per plot are sufficient provided the number of " occasions " is not less than 20. The significance of plot differences in density may be calculated from the analysis of variance of drags. For plots less than 3 acres, the blanket method is easier ; for large areas, especially with varied vegetation cover, tick counts on sheep are preferable.

SHOOTER (R. A.) & WATERWORTH (P. M.). **A Note on the Transmissibility of haemolytic streptococcal Infection by Flies.**—*Brit. med. J.* no. 4337 pp. 247–248. London, 1944.

The possibility that flies, which cannot always be kept away from wounds and septic dressings, might be vectors of haemolytic streptococci was investigated in 1942 in a hospital in England. Flies caught in two surgical wards where there were cases of streptococcal infection, and control flies caught in the laboratory were confined so that they crawled over plates of a culture medium. Nine of 27 flies from the wards gave cultures of haemolytic streptococci, while none of the controls did so. Three of the nine strains belonged to Group A, and

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two of these proved to be of Type 4. As all Group A infections in the wards were typed, a hypothetical relation between the flies and infection could be traced. Type 4 was obtained only from the ward in which the two flies carrying it were taken. It was first found, ten days before the flies were caught, in the sore throat of a nurse from whom a wound infection in which it escaped recognition may have been derived, but during the next two months it was recovered from eight further persons, six having wound and two throat infections. After this, patients infected with it were admitted to both wards, so that a number of further cases in them were not necessarily traceable to the earlier ones.

Atkeson (F. W.), Shaw (A. O.), Smith (R. C.) & Borgmann (A. R.). **Some Investigations of Fly Control in Dairy Barns.**—*J. Dairy Sci.* **26** no. 3 pp. 219–232, 19 refs. Lancaster, Pa., 1943.

An account is given of investigations carried out in a group of large, modern dairy barns in Kansas to assess the effectiveness of a combination of various methods of controlling house-flies (*Musca domestica*, L.). The floors and walls of the milking barn were habitually washed after each milking period. The walls were of glazed tile and the ceiling was plaster coated with enamel paint. Breeding places were eliminated as far as possible, but flies were nevertheless present in considerable numbers.

The following are substantially the authors' conclusions. About one-fourth as many flies were counted in screened barns as in the same barns without screens, when systematic manure disposal and daily spraying had been in progress throughout the summer. With screens and regular spraying, the number of flies in the clean milking barn was not seriously increased when cows entered it, but the number in the bedded calf barn increased greatly when calves were brought in, possibly on account of the smell of the bedding. Spraying was ineffective in a bedded barn unless it was screened, but a combination of screens and spraying gave effective control. The tendency of flies to migrate to light was shown by the fact that nearly five times as many were found on the screens as on the wall in a bedded barn, and more than 11 times as many in a clean barn. This indicates the possible value of such supplementary practices as darkening windows and using screen traps and electric screens. About eight times as many flies were counted on the ceiling and walls on the bedded side of a barn as on the clean side where the floor was scrubbed. About three times as many flies were counted on a floor that had been swept only as on a freshly limed floor in the same barn. The attractiveness of even slightly soiled floors to flies was shown by the fact that there were significantly larger numbers of flies on floors limed the previous day than on freshly limed floors. In a scrubbed barn, the numbers of flies found on an unscrubbed but swept feed alley and the numbers on a scrubbed feed alley did not indicate much advantage in scrubbing the alley, but unscrubbed mangers soiled with feed and saliva had 18 times as many flies on them as had scrubbed mangers. Flies were more numerous on ceilings than on walls, particularly on the sides of ceiling beams. A study of colour preference showed that the flies preferred the darker colours [*cf. R.A.E.*, B **24** 61]. As most dairy barns are painted in light colours for sanitary reasons, it is doubtful whether the colour preference of flies is important in the choice of wall colour.

Seven out of eight sprays tested for knock-down and kill did not cause significantly different knock-down, while one was inferior. Commercial sprays were significantly less lethal than sprays of known composition consisting of pyrethrum (with or without an activator) or Thanite in oil [*cf.* **31** 196]. The superiority of some sprays in both knock-down and kill indicated the need for considering both factors in developing sprays for barns. Satisfactory results were obtained when spray was used at the rate of 1 cc. to 38 cu. ft., or about half the amount used in the Peet-Grady laboratory test. When the full amount

was used, the floors became very slippery. Some difficulty was experienced in the dispersion of sprays made with oils with a viscosity of more than 50 seconds Saybolt [*cf.* **25** 85; **29** 125].

Mills (H. B.). **Montana Insect Pests, 1941 and 1942. Twenty-ninth Report of the State Entomologist.**—*Bull. Mont. agric. Exp. Sta.* no. 408, 36 pp., 8 figs., 2 refs. Bozeman, Mont., 1942. [Recd. 1944.]

Montana is far outside the normal range of *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.), which was first observed there in the summer of 1941, having probably been introduced on cattle from Mexico in April. It attacked cattle, horses, pigs and dogs and caused some loss. It did not reappear in 1942, and it is probably unable to survive the winter so far north. Its life-history is briefly reviewed, and the importance of examining cattle arriving from the south to guard against its reintroduction is emphasised. *Otobius* (*Ornithodoros*) *megnini*, Dugès, also principally a southern species, was observed in numbers on cattle in Montana in 1916 [*R.A.E.*, B **6** 64] but is not known to have been found there again until the spring of 1941, when it was taken from the ears of Mexican cattle. Several lots were reported later in the year, all from the south-eastern part of the State, but none in 1942. Notes are given on its life-history and control [*cf.* **7** 93], a mixture of 2 parts pine tar and 1 part cotton-seed oil at ½ oz. per ear being recommended to kill the ticks and protect the host from reinfestation for about a month. Other pests recorded include *Wohlfahrtia meigeni*, Schin., larvae of which were recovered in June 1941 from young mink that had died, apparently as a result of the infestation.

Babcock (O. G.) & Boughton (I. B.). **Sulfur-feeding Tests for the Control of Ectoparasites of Animals.**—*J. Amer. vet. med. Ass.* **103** no. 799 pp. 209–212, 2 refs. Chicago, Ill., 1943.

Tests were carried out in Texas to determine whether administering sulphur internally to goats or calves would kill the lice that infest them. Angora goats heavily infested with *Damalinia* (*Bovicola*) *caprae*, Gurlt, *D.* (*B.*) *limbata*, Gerv., and *Holakartikos crassipes*, Rudow (*B. penicillata*, Piag.), and lightly infested with *Linognathus stenopsis*, Burm., were used in preliminary tests carried out in 1932. Three received 4·43, 8·86 and 16·4 gm. sulphur daily for 54, 36 and 12 days, respectively, one received 151·76 gm. over a period of 10 days and one 10 oz. within 24 hours. In no case was there any effect on the lice, but the last three goats died. Details are given of the results of more extensive tests with 12 goats and 3 calves in 1939–40, which indicated that daily administration of sulphur in capsules at a rate of 5 gm. per 100 lb. live weight over a period of 257 days had no effect on the populations of the lice infesting the animals, which comprised the same species on the goats and *L. vituli*, L., and *D. bovis*, L. (*B. scalaris*, Nitzsch) on the calves. The sulphur also seemed to be without effect on *Otobius* (*Ornithodoros*) *megnini*, Dugès, a heavy infestation of which developed on one of the calves towards the end of the experiment. All treated and control animals remained healthy throughout.

Tate (H. D.) & Klostermeyer (E. C.). **Cockroach Control.**—*Circ. Neb. agric. Exp. Sta.* no. 72, 8 pp., 5 figs. Lincoln, Neb., 1943.

Blattella germanica, L., *Blatta orientalis*, L., and *Periplaneta americana*, L., are commonly found in houses in Nebraska, and *Supella supellectilium*, Serv., which was first observed there in 1929, and *Parcoblatta pensylvanica*, Deg., are occasionally numerous. It is doubted whether *P. pensylvanica* ever becomes established in houses. Brief notes on the appearance and life-history of these cockroaches are followed by instructions for the application of dusts of sodium fluoride, pyrethrum or borax and bait pastes containing phosphorus for their

control. Stress is laid on the importance of sealing cracks and crevices, keeping food and waste in closed containers and preventing infestation as far as possible by examining goods brought into the house.

Douglas (J. R.) & Wheeler (C. M.). **Sylvatic Plague Studies. II. The Fate of *Pasteurella pestis* in the Flea.**—*J. infect. Dis.* **72** no. 1 pp. 18–30, 14 figs., 1 graph, 14 refs. Chicago, Ill., 1943.

Evans (F. C.), Wheeler (C. M.) & Douglas (J. R.). **Sylvatic Plague Studies. III. An Epizootic of Plague among Ground Squirrels (*Citellus beecheyi*) in Kern County, California.**—*T. c.* pp. 68–76, 1 fig., 17 refs.

In the first paper, an account is given of investigations on the efficiency as vectors of plague of *Ceratophyllus* (*Diamanus*) *montanus*, Baker, one of the commonest fleas on ground squirrels (*Citellus beecheyi*) in California, and the rat flea, *Xenopsylla cheopis*, Roths. The test animals were white mice. The methods used to determine the degree of bacteraemia in the mouse, the number of plague bacilli in a flea at a given time, the capacity of the stomach of the flea, the number of organisms excreted by a flea, and their development in an infected flea are described. It is pointed out that such methods would greatly facilitate the comparative evaluation of data on the vector efficiency of various species of fleas. In rearing the stocks of fleas, *X. cheopis* was fed on rats and *Ceratophyllus montanus* on *Citellus beecheyi*. The host animal and a number of fleas were placed in a glazed earthenware jar containing wood shavings to a depth of about 2 inches, and the jar was covered with a hardware cloth top and kept at a temperature of about 75°F. and a relative humidity of 80–90 per cent. At the end of 4–5 weeks, the host and adult fleas were removed and a small amount of powdered whole blood was mixed with the old nest material to insure an adequate food supply for the larvae. By removing adults from this culture at frequent and regular intervals, fleas of known age could be obtained.

Mice inoculated intraperitoneally with a relatively small number of plague bacilli (20,000) developed a maximum of 10,000,000 per cmm. of blood about 48 hours after infection. The capacity of the stomach of each species of flea, as calculated by counting the number of organisms ingested in the blood meal, averaged 0·030 cmm., so that with the maximum number of bacilli circulating in the peripheral blood of the mouse, either species could ingest an average of 300,000. Six out of ten individuals of *Ceratophyllus montanus* became free from plague bacilli within 24 hours of the infective meal, but none of the ten individuals of *X. cheopis* examined after 48 hours was free. Examination of serial microsections showed that the bacilli can multiply in the oesophagus, proventriculus and stomach of both fleas. The oesophagus of *C. montanus* was invaded twice as frequently as that of *X. cheopis*, but it is shown that in the case of the latter species at least, an oesophageal plug is not necessary for transmission. Occlusion of the lumen of the alimentary tract by the bacillus took an average of 10 days in the former species and 16 days in the latter, and the average periods of survival after this were 5 and 4 days, respectively. The relative efficiency of the two species is discussed in the light of these findings, and it is concluded that *C. montanus* is probably a very efficient vector [*cf. R.A.E.*, B **30** 33]. Viable plague bacilli were found in only 56 per cent. of the daily faecal samples of infected individuals of *C. montanus* and 25 per cent. of those of *X. cheopis*, and always in very small numbers. This is attributed to the smallness of the lumen of the intestine leading from the stomach, which must tend to prevent the passage of clumps of bacilli. While it is not denied that plague may sometimes be acquired by rubbing faecal droplets into abrasions of the skin, the importance of this method of transmission is considered negligible.

The second paper deals with an epizootic of plague that occurred in *Citellus beecheyi* in at least five localities in Kern County, California, in 1941. The apparently discontinuous distribution is believed to be characteristic of plague

epizootics. Knowledge on sylvatic plague is reviewed from the literature. Plague bacilli had previously been isolated from ground squirrels in Kern County only in 1934, though the death of large numbers of the rodents in earlier years had suggested the presence of plague and the recurrence of the disease after seven years suggests that it is established in enzootic form. It has not been recorded from man in Kern County. Infected ground squirrels were found in three localities and infected fleas in all five. Infection was detected only between 24th April and 18th July, with the exception of an infected pool of organs from ten ground squirrels shot on 30th October. The active phase of an epizootic in a given area appeared to be only 2–3 weeks. Infected fleas were found before the epizootic was detected and after it had subsided, and fleas probably provide at least a temporary shelter for the bacilli when the population of the rodent host is low. Among 60 burrows and 35 nests examined, a few burrows were found to contain fresh nests and healthy fleas, but most had been abandoned because of disease. Carcasses of ground squirrels were discovered in 22 burrows, and infected fleas in the entrances of several burrows and in one nest. The fleas taken on the ground squirrels and in their burrows were *Ceratophyllus montanus*, *Hoplopsyllus anomalus*, Baker, and *Echidnophaga gallinacea*, Westw., and all were found infected, the last-named only from a burrowing owl (*Speotyto cunicularia*) [**30** 37]. A decrease in the numbers of fleas was noted in August, and there was some evidence of seasonal replacement of *C. montanus* by *H. anomalus* [*cf.* **30** 34]. Different microclimatic factors at various elevations may determine whether or not this takes place.

MAZZOTTI (L.). **Transmission Experiments with** *Spirochaeta turicatae* **and** *S. venezuelensis* **with four Species of** *Ornithodoros*.—*Amer. J. Hyg.* **38** no. 2 pp. 203–206, 2 refs. Lancaster, Pa., 1943.

The strains of *Spirochaeta venezuelensis* and *S. turicatae* used in these experiments were obtained, respectively, from examples of *Ornithodoros rudis*, Karsch (*venezuelensis*, Brumpt) and *O. turicata*, Dugès, collected in Colombia and Mexico, and the ticks were *O. hermsi*, Wheeler, and *O. parkeri*, Cooley, from laboratory strains originating in Colorado and California, respectively, *O. amblus*, Chamberlain, from hills on the coast of Peru containing natural deposits of guano, and *O. furcosus*, Neum., from dwellings and pigsties in Ecuador. The last two species readily bite man and laboratory animals, and *O. furcosus* is abundant in some parts of Ecuador and feeds on blood in every stage. Relapsing fever apparently does not occur in the localities where *O. amblus* and *O. furcosus* were collected. None of the four species transmitted either spirochaete by biting. Inoculations of suspensions of triturated ticks indicated that *S. turicatae* and *S. venezuelensis* do not live more than a few days in *O. amblus* but may survive at least 274 days in *O. furcosus*. *S. venezuelensis* disappeared from *O. hermsi* and *O. parkeri* and *S. turicatae* from *O. hermsi* in less than 120 days, the only interval at which tests were made, but *S. turicatae* was maintained in *O. parkeri* for at least 304 days. Discussing the discrepancy between this last result and that obtained by Davis [*cf. R.A.E.*, B **31** 177], the author points out that his strain of *O. parkeri* originated from California where Davis found some alleged individuals of this species to be probably hybrids with *O. turicata*.

BANA (F. D.). **Control of** *Aedes egyptus* (*Stegomyia fasciata*) **or Tiger Mosquito (the Carrier of Yellow Fever) in the Bombay Harbour by a patent Mosquito-proof Cap and Tap.**—*J. Bombay nat. Hist. Soc.* **44** no. 1 pp. 139–142, 7 refs. Bombay, 1943.

The results of work on the control of *Aëdes aegypti*, L., in country boats in Bombay harbour between 1935 and 1942 are briefly reviewed [*cf. R.A.E.*, B **26** 207]. The percentage of boats in which *A. aegypti* was breeding fell steadily

from 19·3 in 1936–37 to 5·8 in 1941–42. Metal caps [*loc. cit.*] used in conjunction with taps to draw off the water completely stopped breeding in barrels to which they were fitted and have withstood four years of hard wear.

KIRK (R.). **Some Observations on the Study and Control of Yellow Fever in Africa, with particular Reference to the Anglo-Egyptian Sudan.**—*Trans. R. Soc. trop. Med. Hyg.* **37** no. 2 pp. 125–150, 2 maps, 35 refs. London, 1943.

This is a discussion, largely based on the literature, of the epidemiology and control of yellow fever with particular reference to the outbreak that occurred in the Nuba Mountains District of the Sudan in 1940 [*R.A.E.*, B **29** 115; **30** 88]. The subjects dealt with include the distribution of the disease in Africa (with the conclusion that it is wise to regard the endemic area as co-extensive with the area of immunity [*cf.* **30** 76]), epidemiology in Africa, the control of the disease in communities in which it exists in epidemic form and prevention of its spread to parts of the world at present free from it, and the possibility of its spreading in Africa. Urban yellow fever may be controlled by immunisation of all susceptible persons or elimination of the insect vector. Remarkable success has been achieved in Brazil in the control of urban yellow fever and rural yellow fever transmitted by *Aëdes aegypti*, L., but the control of rural and jungle yellow fever is more complicated where other vectors are involved, and the eradication of endemic infection is not at present envisaged since the means by which it is perpetuated are unknown. The aim in endemic areas is to protect individuals by vaccination, prevent the spread of infection to places outside the area, and eliminate epidemics within it wherever possible. In connection with a consideration of the spontaneous decline of epidemics, experience in the Nuba Mountains epidemic is discussed. This was the first extensive rural epidemic in Central or East Africa for which preventive measures had to be instituted. They were confined to quarantine measures, which are described, to prevent the outbreak from spreading, as it was anticipated that the epidemic would die out when climatic conditions caused the disappearance of vectors other than *A. aegypti* [*cf.* **30** 88; **32** 25], which could then be controlled by the usual measures if necessary.

WILSON (D. B.) & NOTLEY (F. B.). **Malaria in southern Somalia (Italian Somaliland).**—*E. Afr. med. J.* **20** no. 8 pp. 255–262, 1 map, 6 refs. Nairobi, 1943.

Malaria in Italian Somaliland is practically confined to the southern half, which contains the two main ports and parts of two large rivers, the Juba and the Webbe Shebeli. This half is divided into a coastal zone, bounded by high sand dunes, in which Anophelines do not breed, except rarely at Mogadishu, an inland plain with the two rivers to the west and east, which flood during the wet season and near which there is a considerable amount of agriculture, and a low limestone plateau. Malaria is shown to be sporadically distributed over the area and transmitted by *Anopheles gambiae*, Giles. This was the only Anopheline found except in one town (Genale), in which *A. funestus*, Giles, and *A. squamosus*, Theo., were also taken and *A. coustani*, Lav., had been recorded in a paper already noticed [*R.A.E.*, B **26** 67]. Most of the surveys were made in March and April. In one area, the average numbers of *A. gambiae* caught per room rose from 0·4 in April to 4·0 in July. Away from the two main rivers, it breeds chiefly in hoof marks, roadside drains and pits around seasonal collections of rain water, and in the innumerable pools that form between rains and at the end of the rainy seasons in the rocky or shingly beds of the seasonal streams at the junction of the plain and the north-western plateau. Breeding places may be formed along the rivers during either high or low water and as a

result of irrigation, and may be a source of vectors before, during or after the rains. Spleen rates for various centres and parasite rates for one are discussed and compared with data obtained by Italian authors. Over the greater part of the country, malaria has a short season and is therefore epidemic, but there is considerable though not complete immunity in the riverine areas. Various degrees of endemicity occur between these limits.

Other mosquitos found included *Culex fatigans*, Wied., and *Aëdes aegypti*, L., both of which were present in all localities surveyed.

[Beklemishev (V.) & Sergiev (P.).] **Беклемишев (В.) и Сергиев (П.). Antimalarial Rationalisation of Rural Life.** [*In Russian.*]—*Med. Parasitol.* **11** no. 4 pp. 3–11. Moscow, 1942. [Recd. 1944.]

In this paper, which is introductory to those that follow, the authors emphasise the value in malaria control of using domestic animals to keep Anophelines away from man (zooprophylaxis). Diverse opinions on the subject are reviewed, and it is pointed out that the method is feasible in Russia since the Anophelines that occur there show no particular preference for man and are readily attracted to cattle. Its success depends on making an adequate number of cattle available, siting the cow-sheds so that they form an effective screen for the houses, and using supplementary devices that make it difficult for mosquitos to enter the latter. Experiments on its practical application were organised in 1935 in the Republic of Kabarda-Balkar (on the northern slopes of the Caucasus mountains) to obtain data on its value and on the best way of situating the animal quarters, and further investigations were carried out in various regions in 1938–1940, accounts of which are given in the subsequent papers. The results obtained were promising, since there was a reduction in the incidence of malaria in all the villages in which the measure was tested, but the maximum control will not be obtained unless the houses are so built as to hinder the entry of mosquitos and provide unfavourable conditions for those that do enter. It is hoped that such measures will be adopted in the reconstruction in rural areas affected by the war.

[Raevskiĭ (G. E.).] **Раевский (Г.Е.). An Experiment on Malaria Zooprophylaxis in the Village Shitkala, Kabardino-Balkarian ASSR (1938–1940).** [*In Russian.*]—*Med. Parasitol.* **11** no. 4 pp. 11–21, 1 diagr. Moscow, 1942. [Recd. 1944.]

[Sheĭnker (K. P.).] **Шейнкер (К. П.). The Efficiency of Zooprophylaxis in a Village with a high Malaria Incidence.** [*In Russian.*]—*T.c.* pp. 22–28, 1 graph.

In the first paper, a detailed account is given of an experiment in a village in the Caucasus in which the incidence of malaria was high. Most of the cattle were pastured in the mountains from May to October, so that the average number that remained per house was only 1·8 in 1938, 0·95 in 1939 and 0·93 in 1940. The Anophelines present, in descending order of abundance, were *Anopheles maculipennis*, Mg., the principal vector of malaria, *A. claviger*, Mg. (*bifurcatus*, auct.), which was fairly abundant in houses and animal quarters, but was not found infected, and *A. hyrcanus*, Pall., and *A. plumbeus*, Steph., which were rare. *A. maculipennis* was represented by vars. *typicus*, *atroparvus*, van Thiel, and *messeae*, Flni., but the last two were uncommon. The village was surrounded by breeding places, but the Anopheline population varied considerably from year to year.

The village contained 44 houses situated along either side of a single street, with sheds arranged irregularly close behind most of them in which cattle were kept at night. In order to increase the protective effect of these, it was planned to arrange them in a uniform line at intervals of about 165 ft. (the distance between the houses).

The work was not completed in 1938, and in 1939, when the sheds were constructed about 350 ft. behind the houses, it was not completed before infective mosquitos were present. During the following winter, the sheds were moved up to about 100 ft. behind the houses. Complications arose in all years because of gaps in the line, some houses having no sheds, and because the cattle were often left in the open close to the houses until well after sunset, instead of being taken to the sheds at once. Nevertheless, there were considerable and progressive reductions in the parasite rates and the percentage of females taken in the houses, while these figures remained more or less constant in a similar village nearby that was used as a control. The full results for both are shown in a table.

It is concluded that the method shows great promise, but that less than one cow per house is not sufficient for the prevention of fresh infection if Anophelines are abundant and the percentage of gametocyte carriers among the population is high. The interval of 165 ft. between the sheds should be considered as a maximum, because the absence of even only one shed in the line forms a wide gap through which mosquitos readily penetrate into the houses. Sheds less than 33 ft. from the houses, as in the control village, did not keep mosquitos out of them, but a distance of 100 ft. proved very suitable, and the inhabitants were not attacked in the open between the sheds and the houses.

In the second paper, the work is again reviewed, stress being laid on its effect on malaria. The considerable improvement in the malaria situation towards the end of 1940 is illustrated by the parasite, spleen and endemic indices, and the reduction in the percentage of fresh cases of infection among the inhabitants, the figures given and the general conclusions as to the value of zooprophylaxis being the same as in the first paper.

[Platonov (N. V.) & Tarabukhin (I. A.).] **Платонов (Н. В.) и Тарабухин (И. А.). An Experiment on Malaria Zooprophylaxis in West Siberia.** [*In Russian.*]—*Med. Parasitol.* **11** no. 4 pp. 29–38. Moscow, 1942. [Recd. 1944.]

This experiment was carried out in a village in the Province of Novosibirsk near the left bank of the river Ob and had been preceded by several years' observations on the seasonal history there of *Anopheles maculipennis*, Mg., the only Anopheline present. Of 259 batches of eggs examined, one belonged to var. *typicus* and the rest to var. *messeae*, Flni. The overwintered females emerged and began to feed in April or May and the first generation was completed in about a month. Some females with a developed fat-body were found in late July or early August, but feeding continued till between 20th September and 16th October. During the day the mosquitos sheltered in dark, dirty sheds belonging to the houses and used for cattle or pigs, and in the houses themselves, which often included animal quarters under the same roof, but they did not occur in the clean, light and well ventilated quarters of the communal cattle.

For the purpose of the experiment, uniform sheds of wattle and daub were built in 1939 and 1940 at distances of from 20 to 130 ft. from the houses, the intervals between the sheds ranging from 23 to 590 ft. Catches of mosquitos showed that whereas in 1938 the average numbers per living room, entrance passage and adjoining cattle shed had been 9·9, 16·7 and 106·2, in 1940 these figures fell to 0·05, 0 and 61·5, respectively, and the average number taken in the new protective shed was 1,187·1. Furthermore, none of the females taken in the houses in 1940 contained human blood, as compared with about 0·5 per cent. in 1938, although individuals containing human blood were taken in the protective sheds and in close proximity to them. There were no attacks on man by mosquitos outdoors in the protected parts of the village.

The effect of the work on the malaria situation in the village is given in tables showing the results of surveys made in 1937–40 among various age groups of the population in the experimental village and in another that served as a control. There was a general and progressive improvement in both. The annual reduction in the numbers of primary cases of malaria, and their complete absence in 1940, are believed to be due in the control village to the draining of an adjoining large swamp that afforded numerous breeding places for Anophelines, and in the experimental village to the effect of the protective line of cattle sheds.

[Zavoĭskaya (V. K.).] **Завойская (В. К.). An Experiment on Malaria Zooprophylaxis in a Village on the Kutuluk Barrage Lake.** [*In Russian.*]—*Med. Parasitol.* **11** no. 4 pp. 38–46, 2 diagrs., 2 graphs. Moscow, 1942. [Recd. 1944.]

The investigations described were carried out in 1939 and 1940 in two villages near a large artificial water reservoir on a tributary of the Samara in the Province of Kuĭbuishev. Anophelines bred in numbers in shallow inlets of the reservoir, which were covered with aquatic vegetation, and in the impounded part of the local river. The only species found was *Anopheles maculipennis*, Mg., of which var. *messeae*, Flni., constituted 96 per cent., and var. *typicus* 4 per cent. Parasite and spleen rates were high in the spring of 1939 but were reduced considerably during 1939 and 1940 by systematic medical treatment. The protective line of cattle sheds was built at a distance of about 18 ft. from the houses in one village, and about 36 ft. in the other, the interval between the sheds being 65 ft. in both. The number of cattle per house averaged approximately 4·8 in each village, and there were almost as many sheds as houses. The protection afforded by the sheds was only moderate when they were 18 ft. from the houses, but in the village in which they were 36 ft. away only one female was taken in the houses during the whole season of 1940, and thus contact between mosquitos and man was almost completely broken.

[Raevskiĭ (G. E.).] **Раевский (Г. Е.). Methods of using Entomological Data in Epidemiology.** [*In Russian.*]—*Med. Parasitol.* **11** no. 4 pp. 46–52, 12 refs. Moscow, 1942. [Recd. 1944.]

The author points out that conclusions on the transmission of malaria based on data such as the sporozoite index of Anophelines or the results of precipitin tests of the blood they contain are frequently inaccurate because these data themselves are only approximate. He describes more precise methods of analysing entomological data, evolved in the course of four years work on zooprophylaxis in the Russian Union.

To calculate the dates in a given year on which the sporozoites in the mosquitos will first mature in a given locality, it is necessary to know the date on which the first-generation adults begin to emerge and the mean daily temperatures of the air from that day onward. The author has found that overwintered females can be neglected in practice, since they usually die before becoming infected or before the sporozoites have time to mature. The earliest possible date on which mature sporozoites can occur is obtained by multiplying the numbers of days at each temperature by the percentage of development completed in a day by the *Plasmodium* in the mosquito at the corresponding temperature. These percentages are calculated from a table, which is given, showing the durations of extrinsic development of the *Plasmodium* at various temperatures. The date on which the sum of these products reaches 100 is the earliest possible date on which infection of man can take place. Fresh malaria cases may then appear after the usual incubation period (11–14 days).

Since this method is based on daily temperatures, it is more accurate than those based on mean monthly or 10-day ones, which have been generally adopted heretofore, but a correction is necessary in the case of species such as *Anopheles maculipennis*, Mg., which usually digest their blood-meals while resting in buildings, since the temperature in these shelters may differ from that of the air outside.

The extent of the contact between man and mosquitos in a locality is usually estimated by expressing the total number of mosquitos that contain human blood as a percentage of the total number that give a positive reaction in precipitin tests. This method is generally inaccurate, however, since it takes no account of variations in the percentages among the mosquitos taken in different types of shelters. In general, three types should be considered, *viz.*, inhabited houses, animal quarters and empty buildings, but others should be included if necessary. The percentages of stomachs containing human blood should be calculated separately for each type of shelter, and then multiplied by the total numbers of mosquitos occurring per day in all the shelters of that type in the locality, which may be obtained by multiplying the average daily numbers in shelters in which catches are made by the total number of shelters. The sum of these products gives the total number of mosquitos in the locality on a given day that have fed on man, and this can be expressed as a percentage of the total number of mosquitos in the village, obtained in the same way. This value is termed the coefficient of contact between man and mosquito and is considered to give a truer picture than that obtained by other methods.

It is pointed out in a foot-note that since mosquitos do not feed every day, the average number containing human blood in day-time shelters will exceed the number that actually fed on man on one day. The latter figure can be obtained by dividing the number of mosquitos containing human blood by the average number of days required to complete digestion under the conditions prevailing in the shelter. By further dividing this quotient by the number of inhabitants in the village, the average number of mosquito bites per day per inhabitant is obtained.

Finally, it is recommended that the sporozoite index should also be based on separate calculations for each type of shelter. Averages should be obtained for each month, so that the most dangerous period for malaria infections can be recognized, and an example of the working of the method is given.

[Raevskiĭ (G. E.).] **Раевский (Г. Е.). On the Effect of certain Factors on the Effectiveness of Malaria Zooprophylaxis.** [*In Russian.*]—*Med. Parasitol.* **11** no. 4 pp. 52–57, 12 refs. Moscow, 1942. [Recd. 1944.]

Since mosquitos are chiefly guided by smell in their search for food and shelter, the wind that carries the odours of an inhabited place to their breeding places should be the main factor responsible for the direction of their flight. Investigations on this by various European workers have resulted, however, in very diverse conclusions and this is thought to have been due to insufficiently detailed observations on wind directions and the rapid variations that occur throughout an area. An account is given of observations in the Republic of Kabarda Balkar (Caucasus) which showed that the changes in direction of a wind with a velocity of 1–3 Beaufort [1–12 miles per hour], at which mosquitos fly normally, reached 45–70° in an hour at a height of 13 ft. and occasionally attained 180° in the course of a night. It is calculated, therefore, that wind of a given direction recorded in a village will carry the odours to breeding places of mosquitos situated 3,000 yards away along a stretch 2,000–3,500 yards wide. The direction of wind was also found to differ considerably at points only a few hundred yards apart, and it is suggested, therefore, that the direction of the flight of mosquitos to a village should be defined as occurring from the windward or leeward side.

After a night of wind with a velocity of 1–12 m.p.h., the numbers of Anopheline females per shed in protective cattle sheds situated on the windward side of a village averaged 33·5 as compared with 16·3 in those on the leeward side; the average for all sheds was 19·3 after a windless night. Of these numbers, about 72, 42 and 68 per cent., respectively, were in the early stages of digestion and so had entered the sheds during the night preceding the catch. It appears, therefore, that mosquitos fly against a light wind, and that the number of mosquitos that enter the shelters decreases somewhat in the absence of wind, though they are more evenly distributed over the village. The distribution of mosquitos in shelters close to the breeding places was independent of the direction of wind. In the open air, females of *Anopheles maculipennis*, Mg., did not respond to faint odours even at a distance of only a few yards, and very few entered cages made of muslin or wire netting containing two observers. The only method of studying their activity was to allow them to attack an unprotected observer.

Since it is customary to leave the cattle outdoors on hot summer nights, observations were made to determine whether this would reduce the effectiveness of protective cattle sheds. It was found that the number of mosquitos in an unoccupied shed after the cow had spent the night in the open close to it, was not smaller than in neighbouring sheds in which the cows were stabled for the night. Precipitin tests also showed that keeping the cattle outdoors near the sheds did not increase the chances of infection for persons who entered the zone between the line of sheds and the houses in the evening. No mosquitos occurred, and no malaria case was recorded, in houses situated close to a dairy farm in the yard of which the cows passed the night.

[Rakhmanova (P. I.).] **Рахманова (П. И.). Evaluation of the Fitness of various Types of Stables and of various domestic Animals in the Zooprophylaxis of Malaria.** [*In Russian.*]—*Med. Parasitol.* **11** no. 4 pp. 57–60. Moscow, 1942. [Recd. 1944.]

In the course of work in 1935–40 in the Russian Union on the use of domestic animals for the protection of man from attack by *Anopheles maculipennis*, Mg., a special study was made of the different types of animal quarters in villages in the Caucasus to determine which are the most suitable for the purpose.

Mosquitos were not attracted by the large sheds for the communal cattle, which house 25–60 animals and are light and very airy have a relative atmospheric humidity of 40–70 per cent. and are kept clear of dung. If they were provided with double doors at each end or in the middle, however, large numbers of mosquitos congregated in the dark or semi-dark spaces between the doors, entering the shed itself only to feed on the animals. The standard sheds for the communal cattle can therefore be effectively used for zooprophylaxis if they are provided with double doors.

Of the small sheds for privately owned animals in the yards of the individual houses, penthouses and sheds made of wattle were unsuitable because they usually became too hot in summer and the ceiling and walls became wet in rainy weather, which repelled the mosquitos and was bad for the animals. Mud-sheds, though excellent shelters for mosquitos, were quite unfit for cattle. Sheds with plaster walls, built of logs or earth mixed with straw, proved to be the best, provided that the entrance or an open window faced the breeding places of the mosquitos. Good ventilation and a roof that is water- and heat-proof are essential, as the average number of females in hot stuffy sheds with no ventilation was only half that in well-ventilated sheds, and the number of mosquitos in dwelling houses increased sharply after heavy rains if the cow-sheds became wet inside.

Observations on the host preferences of females of *Anopheles maculipennis* var. *typicus*, determined by means of precipitin tests, showed that very few fed on dogs and less than 0·1 per cent. on birds, though geese and turkeys were

numerous in the village. On the basis of results for mosquitos from neighbouring sheds housing different animals, it is calculated that two attacks on a goat correspond to five on a calf, 10 on a pig, 20 on a cow and 60 on a buffalo. This confirms unpublished findings by Beklemishev that the attractiveness of different animals is directly proportionate to the extent of their body surface and the amount of heat and odour they give off. It is evident, therefore, that all kinds of domestic animals are not equally valuable for deviating mosquitos and that the intervals between sheds in a protective line should be related to the size of the animals available. Small animals will serve as a substitute for a large one if they are housed together in numbers.

[Polumordvinov (A. D.).] **Полумордвинов (А. Д.). The Attraction of *Anopheles maculipennis messeae* by various Animals.** [*In Russian.*]—*Med. Parasitol.* **11** no. 4 pp. 61–63. Moscow, 1942. [Recd. 1944.]

Observations on the comparative attractiveness of various domestic animals for *Anopheles maculipennis* var. *messeae*, Flni., were carried out in the summer of 1940 in a village near Kazan. The mosquitos were collected once every ten days between 19th July and 15th September from ten occupied stalls in a large communal shed that contained a total of 46 stalls, of which 35 were occupied at night by horses and 4 by cows. Mosquitos had easy access to the animals through the doors and broken windows. The results, which are tabulated, showed that the average numbers of mosquitos taken per stall were ten times as great for cow stalls as for those of horses, and that of the 159 mosquitos that gave positive reactions in precipitin tests, 144 had fed on cattle, 9 on horse, 8 on sheep, 2 on man, 7 on pig and 0 on birds; these mosquitos included 4 that had fed on both cattle and horse and 1 that had fed on both cattle and man. As an explanation of the comparative frequency of interrupted feeding on horse, it is suggested that horses are possibly more sensitive to mosquito bites than cattle and drive them away more frequently.

Of the females caught during the same period in five houses and the adjoining animal sheds, only two were taken in living quarters, as compared with over 2,000 in the sheds, which were used chiefly for cattle, as the horses were stabled in the communal shed. The results of precipitin tests showed that of the 446 that gave positive reactions, 431 had fed on cattle, 12 on sheep, 6 on man, 2 on horse, 1 on pig and 1 on a bird; these included 4 that had fed on both cattle and man, 2 on cattle and horse, and 1 on cattle and the bird. The attack on man probably occurred in the entrances of the houses, where the population mostly slept in July and August. Malaria sporozoites were found in August in the salivary glands of one female out of the 469 dissected.

It is concluded from this work that horses are of less value than cows for deviating mosquitos from man. In the village in which the investigations were carried out, the number of domestic animals averaged 2·87 per house. With the exception of the horses, they were distributed fairly evenly over the village, and deviated 98·7 per cent. of the mosquitos from man.

[Raevskiĭ (G. E.).] **Раевский (Г. Е.). Proposals for the Use of Zooprophylaxis against Malaria.** [*In Russian.*]—*Med. Parasitol.* **11** no. 4 pp. 64–67. Moscow, 1942. [Recd. 1944.] **Antimalarial Requirements in the Planning of Settlements.** [*In Russian.*]—*T.c.* pp. 68–71. **Explanatory Note to the preceding Requirements.** [*In Russian.*]—*T.c.* pp. 71–78, 1 fig., refs.

The instructions outlined in the first two of these papers are for use in the planning or rebuilding of towns and villages in the Russian Union. The first concerns only the use of domestic animals to deviate Anophelines from man, but the second also includes other measures of town and country planning designed to reduce attack. The third paper is a discussion of the recommendations made in the second.

[Trofimov (G. K.).] **Трофимов (Г. К.). Experiments on the Cold Resistance of the Larvae of *A. pulcherrimus* Theob. and *A. bifurcatus* L.** [*In Russian.*]—*Med. Parasitol.* **11** no. 4 pp. 79–81, 7 refs. Moscow, 1942. [Recd. 1944.]

In view of Russian records that hibernating larvae of *Anopheles pulcherrimus*, Theo., do not survive severe winters [*cf. R.A.E.*, B **14** 130], laboratory experiments on their resistance to cold were carried out in January and February 1938 in Baku. Third-instar larvae collected in central Azerbaijan were used, and larvae of *A. claviger*, Mg. (*bifurcatus*, auct.) in the second and third instars taken in wells near Baku were also included. The larvae were kept in water in test tubes suspended above cooling mixtures in thermos flasks, and the results showed that all the larvae were killed when the water in the test tubes froze into ice, but that with the exception of one of four larvae of *A. pulcherrimus*, they survived if the water was supercooled and did not freeze. The temperatures of the air in the flasks and the periods of exposure ranged from −5 to −15°C. [23–5°F.] and from 1½ to 12 hours when the water froze and from −5 to −9°C. [23–15·8°F.] and 20 to 210 minutes when it did not. The larvae also survived if the water was partly frozen, provided that they were not in immediate contact with ice. The freezing and undercooling temperatures of the larvae were not ascertained, but the author assumes that freezing takes place at body temperatures only slightly below 0°C. [32°F.], since it has been found that the haemolymph of the larvae and newly emerged adults of *A. maculipennis*, Mg., and of the adults of *A. pulcherrimus* freezes at temperatures between −0·5 and −0·7°C. [31·1–30·74°F.]. Larvae of *A. pulcherrimus* have been recorded in Turkmenistan as hibernating in shallow water that may easily freeze to the bottom in severe winters. In central Azerbaijan they occurred in shallow flood water from irrigation ditches, but it is not known whether they can survive in ice in a state of undercooling.

[Kalandadze (L. P.) & Kanchaveli (G. I.).] **Каландадзе (Л. П.) и Канчавели (Г. И.). Tests of some Larvicides for the Control of Mosquito Larvae in domestic Reservoirs.** [*In Russian.*]—*Med. Parasitol.* **11** no. 4 pp. 81–84. Moscow, 1942. [Recd. 1944.]

A survey in 1941 in various towns in Georgia showed that mosquitos were breeding in large numbers in water in barrels, cisterns and reservoirs, established for fire-fighting purposes. Various possible larvicides were therefore tested in the laboratory and in barrels in the yards of houses in Tiflis.

Used motor oil, large quantities of which were obtainable from garages and tractor parks, had been employed earlier in the year to control larvae and pupae of *Anopheles* and *Culex* in water moderately overgrown with vegetation, and gave complete mortality in 24 hours at the rate of 0·6 fl. oz. per sq. yd. when the temperature of the surface water was 27–29°C. [80·6–84·2°F.]. The oil had a high spreading power, which increased as the temperature rose, and formed a continuous thin film. In the barrels, the temperature of the water ranged from 25 to 30°C. [77–86°F.] and the eggs, larvae and pupae of *Culex* were abundant. The oil killed all the larvae in 24 hours when it was applied at rates of 0·45–1·2 fl. oz. per sq. yd. and the pupae in 30–60 minutes at the rate of 0·6 fl. oz. per sq. yd. Complete mortality of the eggs was not obtained, but the larvae that hatched soon died. The resistance of the larvae decreased with increasing age. In a flooded basement in which *Culex* was breeding, and the temperature of the water was only 18–19°C. [64·4–66·2°F.], the oil was completely ineffective, and it is concluded that it should not be used at temperatures below 20°C. [68°F.].

Chloride of lime applied in barrels of 22 gals. capacity at rates of 1 : 10,000 and 1 : 20,000 at 15°C. [59°F.] killed all the larvae in 3 and 6 days, respectively, but was ineffective against the pupae. It was best applied by mixing it

thoroughly with about 2 gals. water from the barrel and then stirring the mixture into the rest of the water.

The length of time for which chloride of lime remains effective was tested by placing larvae of *Culex* in water reservoirs at successive intervals after treatment. The experiment was terminated by cold weather after a month, but in that time all the larvae were killed by applications at rates of 12 oz. or 1 lb. per 100 gals.

Larvae survived in 1–1½ per cent. solutions of sodium chloride, but all died in 2 per cent. solutions, those of the third and fourth instars being the most susceptible. The pupae survived even in 6–7 per cent. solutions, and it is recommended, therefore, that the salt should be added to the water before the larvae pupate. Formalin (40 per cent. formaldehyde) did not give complete mortality at rates of up to 2 per mille, and copper sulphate, ferrous sulphate and quicklime were ineffective.

[Derbeneva-Ukhova (B. P.).] **Дербенева-Ухова (В. П.). On the Development of Ovaries and on the imaginal Nutrition in Dung-flies.** [*In Russian.*] —*Med. Parasitol.* **11** no. 4 pp. 85–97, 4 figs., 1 graph. Moscow, 1942. [Recd. 1944.]

In order to facilitate the determination of the physiological age of populations of Muscoid flies that breed in dung, a study was made in Moscow of the process of maturation of the ovaries in *Musca domestica*, L., and 14 other species of Muscoids. Data in the literature are reviewed, and it is considered that the five stages of ovarian development distinguished by Christophers for mosquitos [*cf. R.A.E.*, B **29** 93], with the two additions recently described by Mer [**25** 36], can be applied to these flies [*cf.* **32** 52]. The eight stages distinguished are described in detail for *M. domestica* and differences in the manner of development of the follicles in the various flies are discussed.

The author has shown that dung flies can be divided into three groups according to their oviposition habits [**32** 52]. The third group, in which the eggs mature singly, comprises all the larviparous forms but apparently only one egg-laying Muscoid, *Myospila meditabunda*, F., the larvae of which are predacious and breed both in small lots of dung and in manure heaps. The larviparous species develop in small lots of dung and their mode of reproduction reduces the mortality of the immature stages. It increases the expenditure of nutritive substances by the parent females, however, and larviparous species are in consequence less prolific than oviparous ones. Observations are recorded on the development of the follicles in *Musca larvipara*, Schn. & Dzied., and *Mesembrina meridiana*, L., of which the former deposits larvae in the second instar, and the latter mature first-instar larvae.

The relation between the maturation of the eggs and adult feeding is discussed [*cf.* **24** 71 ; **32** 52] ; in experiments in which females of *Musca larvipara* and *Mesembrina meridiana* were fed on sugar solution only, the first egg matured and the first larva developed autogenously. Dissections of flies showed that the digestive tract functions differently in species that differ in their feeding habits. In coprophagous species, the manure (which contains albumen) filled the stomach, whereas the crop contained a transparent fluid, which in several instances was found to consist of carbohydrates. In *Musca larvipara*, *M. autumnalis*, Deg., and *M. tempestiva*, Fall., which imbibe blood from wounds made on animals by Tabanids but also feed on dung, the crop usually contained a transparent fluid and the stomach was filled with blood, though in many instances blood also passed into the crop. In the case of *M. domestica*, which is polyphagous, the crop and stomach both contained the same material. Thus, flies that breed in dung apparently require both carbohydrates and albuminous substances, the first for general metabolism and the second for the development of the eggs.

The flies can be divided into five groups according to the source from which they obtain the nitrogenous substances that are necessary for ovarian development. These are the obligatory coprophagous species, which obtain all their albuminous nutriment from dung, facultative coprophagus species, such as *Muscina stabulans*, Fall., *M. assimilis*, Fall., and *Fannia* spp., which in addition to dung also feed on faeces, kitchen refuse and foodstuffs, obligatory and facultative feeders on the blood of animals, of which the latter also feed on the secretions of the mucous membranes and on dung, and polyphagous species, including *Musca domestica*.

[Smirnov (E. S.).] **Смирнов (Е. С.). Mechanical Control of the Larvae and Pupae of synanthropic Flies.** [*In Russian.*]—*Med. Parasitol.* **11** no. 4 pp. 97–105, 3 refs. Moscow, 1942. [Recd. 1944.]

In view of the shortage of insecticides in the Russian Union and the results of experiments showing that compressing the soil prevents the larvae of various flies from finding favourable sites for pupation [*R.A.E.*, B **31** 223], laboratory and field tests were carried out in and near Moscow in 1941 on the effect of compressing the soil above the larvae and pupae to prevent the newly emerged adults from reaching the surface.

In the laboratory tests, counted numbers of larvae, pupae, or both, were placed in glass containers and covered with sand, clay or earth, which was compressed to various degrees of compactness. The containers were then kept at room temperature until the emergence of the adults from control jars was complete. In tests with pupae of *Phormia terraenovae*, R.-D. (*groenlandica*, Zett.) and *Calliphora erythrocephala*, Mg., in sand, and pupae of *C. erythrocephala* and *Lucilia caesar*, L., in earth, no adults appeared from the containers with the most compact medium, and examination showed that those that had emerged had died at a depth of 3–6 ins., having been unable to make their way through the compact layer. In containers with clay, however, which formed separate layers after being wetted, flies emerged even from the most compact series, though they were only half as abundant as in the control. In experiments with mature larvae of *L. caesar*, no adults emerged through sand of maximum compactness, and only one through the most compact earth, whereas practically all did so through earth of medium compactness. When mature larvae of *Phormia* were placed under slightly wetted clay, no adults reached the surface from the most compact series, but 50 per cent. did so from that of medium compactness.

To determine the thickness of the compact layer required to prevent the appearance of flies on the surface, pupae of *C. erythrocephala* and *L. caesar* were covered with layers of sand of maximum compactness, the thickness of which varied from 2 to 6 ins. No adults appeared, and examination of the sand showed that all the pupae under the thinnest layer had been killed by pressure and external injury, but that as the layer became thicker an increasingly greater number of adults had emerged, some of which had begun to move upwards before dying. In similar tests with earth and pupae of *C. uralensis*, Villen., no flies appeared on the surface of the thinnest layer, though some of the pupae had given rise to adults, but about 70 per cent. emerged from the thickest layer. In experiments with mature larvae of *C. erythrocephala*, several flies made their way out through the thinnest and medium layers of sand, but not through the thickest, whereas the reverse occurred in earth.

To determine the effect of nutrition, second-instar larvae of *C. erythrocephala*, *P. terraenovae* and *L. caesar* were buried with the carcass of a rat under compact sand. The percentages of flies that appeared on the surface were 97·6, 10 and 0, respectively ; the empty puparia of *Phormia* chiefly occurred at the bottom of the container, whereas those of the other two were mostly in the upper layers. Similar results were obtained with earth.

In field experiments, cylindrical pits 40 ins. deep and 40 ins. in diameter were dug in clay and the carcass of a rat infested with eggs or larvae of various species was placed at the bottom of each. The pits were then filled with soil, which was left loose in the control pits, but was pressed to a compact mass in the others, additional soil being pressed in until the surface was level with the ground. Cold weather at the end of the summer interrupted the development of the larvae and pupae so that no adults had appeared when the pits were examined in September. The examination showed that, on abandoning the carcass the larvae had migrated upwards to pupate and were close to the surface. Both larvae and pupae were in the centre of the control pits, but occurred at the sides in the others because the larvae had moved horizontally under the compressed soil and then vertically in earth loosened at the side. This loosening of the soil was prevented in subsequent tests by digging the pits with sloping sides. Experiments with larvae of *Musca domestica*, L., were inconclusive, but burying the pupae in a pit 20 ins. deep in clay soil which was then compressed prevented the adults from reaching the surface.

It is concluded that burying refuse and carcasses infested by the larvae and pupae of flies and compressing the soil above them is an effective method of control. The soil should be thoroughly compressed, as otherwise some species of flies (including *Lucilia sericata*, Mg.) would be protected from competitors and parasites [*cf.* **20** 259].

[Kalandadze (L. P.) & Chilingarova (S. V.).] **Каландадзе (Л. П.) и Чилингарова (С. В.). The Rôle of Substrates in the Oviposition and pre-imaginal Development of *Musca vicina* Macq.** [*In Russian.*]—*Med. Parasitol.* **11** no. 4 pp. 105–112, 4 graphs, 14 refs. Moscow, 1942. [Recd. 1944.]

Experiments were carried out in 1939 and 1940 in Georgia to compare the attractiveness of common kinds of dung to ovipositing females of *Musca domestica vicina*, Macq., and their suitability for the development of the larvae.

Observations in an insectary with reared flies showed that at an average temperature of 27–29°C. [80·6–84·2°F.] and a relative humidity of 51–61 per cent., both horse and sheep dung ceased to attract the flies after one day because it dried out on the surface and later became mouldy [*cf. R.A.E.*, B **26** 243]. Pig and buffalo dung remained attractive for 2 or 3 days, and cow dung for 5. Liquid dung of any kind was hardly ever visited. Counts of egg batches deposited daily showed that the greatest number was laid on sheep dung, provided that it was fresh, followed in descending order by that of pig, horse, cow and buffalo, and the feeding preferences of the adults showed a similar order. The durations of larval and pupal development were 5 and 5 days in horse dung, 5–6 and 7 in sheep dung, 6–8 and 7 in pig dung, 7–8 and 7 in buffalo dung and 8–10 and 10 in cow dung, respectively.

Field experiments were carried out with boxes to which fresh dung or yard sweepings were added daily. The greatest number of egg batches was laid in pig dung, which had the strongest odour, followed in descending order, by sheep, horse and buffalo dung, and the sweepings. The attractiveness of buffalo dung is decreased by the crust that forms on the surface [*cf.* **24** 45]. The larval stage was shortest (5–7 days) in sheep dung, somewhat longer in horse dung and sweepings, and longest (8–12 days) in pig and buffalo dung, which remained moist longest. Counts of pupae showed that the rate of survival was lowest in the media that dried out the quickest (sheep and horse dung), because though the development of the larvae in them was accelerated, many died from starvation and the adverse effect of moulds.

No relation could be detected between the temperature of the medium and oviposition, but observations in autumn showed that the number of egg batches laid decreased sharply with a sudden drop in the air temperature and that

oviposition ceased at 10°C. [50°F.] though the temperature was still 15–20°C. [59–68°F.] in the upper layer of dung.

[Naumov (K. G.) & Mezentzeva (A. A.).] **Наумов (К. Г.) и Мезенцева (А. А.). Tick Relapsing Fever and its Vector** *Ornithodorus papillipes* **in South Kirghisia.** [*In Russian.*]—*Med. Parasitol.* **11** no. 4 pp. 118–119, 5 refs. Moscow, 1942. [Recd. 1944.]

Ornithodoros tholozani, Lab. & Mégn. (*papillipes*, Bir.) was found in Kirghizia for the first time in 1935. Examples taken in April 1939 in débris on the floor of a flat in the town of Kzuil-kiya (an important coal-mining centre) transmitted spirochaetes to the guineapigs on which they were fed, and the three people who lived in the flat had all recently recovered from tick-borne relapsing fever. Uninfected ticks were taken in the walls of a stable. In a village about a mile away, infected ticks were taken in a living room in September, and uninfected ones in stables, a cow-shed and two caves on a high road. The local houses, which are mostly built of earth mixed with straw, offer favourable conditions for infestation.

[Pavlovskiĭ (E. N.) & Teravskiĭ (I. K.).] **Павловский (Е. Н.) и Теравский (И. К.). On the Susceptibility of** *Nesokia indica* **and** *Cricetulus migratorius* **to Tick Relapsing Fever.** [*In Russian.*]—*Med. Parasitol.* **11** no. 4 pp. 120–121. Moscow, 1942. [Recd. 1944.]

Since *Nesokia indica* and *Cricetulus migratorius* frequently occur in close proximity to inhabited houses in Central Asia, they might serve as hosts for *Ornithodoros tholozani*, Lab. & Mégn. (*papillipes*, Bir.), which transmits relapsing fever, and the experiments here described showed that both these rodents are easily infected artificially with spirochaetes of a Pamir strain.

[Rubinshteĭn (B. B.).] **Рубинштейн (Б. Б.). On the Technique of the Use of Paris Green Suspension for Control of Mosquito Larvae.** [*In Russian.*]—*Med. Parasitol.* **11** no. 4 p. 122, 1 fig. Moscow, 1942. [Recd. 1944.]

Suspensions of Paris green, kerosene and water are effective against Anopheline larvae, but require frequent agitation during application [*cf. R.A.E.*, B **32** 2]. To effect this, the author has devised an apparatus consisting of the pump with which the suspension is applied and an air pump clamped to the side of it, which forces air through the mixture in the bucket, thus keeping it agitated. Both pumps are worked at once by a common handle, but the air pump can be freed and used alone to provide preliminary agitation. The construction of the apparatus is described and figured.

[Kon' (Ya. S.), Dobrosmuislov (D. I.) & Ginzburg (Z. L.).] **Конь (Я. С.), Добросмыслов (Д. И.) и Гинзбург (З. Л.). Mosquito Larvae in the Tunnels of the Moscow underground Railway.** [*In Russian.*]—*Med. Parasitol.* **11** no. 4 pp. 122–123. Moscow, 1942. [Recd. 1944.]

In November 1939, larvae, pupae and adults of both sexes of *Culex pipiens*, L., were discovered in the underground railway in Moscow, after the workmen had been attacked by mosquitos. These findings were similar to those in London in 1940 [*cf. R.A.E.*, B **29** 18]. The mosquitos did not occur in places with strong air-currents, but congregated in the blind ends of passages, and also occurred in the tunnels and offices. Larvae and pupae were numerous in the drains from a lavatory in one station, in spite of the pollution of the water, deficiency of air, and an almost complete absence of light. The numbers of mosquitos were greatly reduced by cleaning the drain and treating the breeding places with chloride of lime. Infestation recurred in some stations in 1940,

but was controlled by treating the breeding places with a suspension of Paris green and destroying the adults. In April 1941, however, males and engorged females were still present in the offices of one station, and breeding places were found in the cable trenches.

As pools of water in the tunnels and other parts of the underground system are not numerous or large, it should not be difficult to prevent mosquitos from breeding in them. Even periodical sweeping with a broom would be effective.

[Pirumov (Kh. N.).] **Пирумов (Х. Н.). An improved *Gambusia* Pond.** [*In Russian.*]—*Med. Parasitol.* **11** no. 4 pp. 123–124, 1 fig. Moscow, 1942. [Recd. 1944.]

Since its introduction in 1924, *Gambusia* has proved of considerable value against Anopheline larvae in the Russian Union and is established in some districts. In others, however, it does not survive the winter or is washed away when the rivers are in flood, so that a stock has to be maintained for release. A description is, therefore, given of a pit, lined with cement, in which the fish have been reared and kept successfully. It has a wall to exclude frogs and is about 8 ft. deep, 12 ft. in diameter at the top and 4 ft. in diameter at the bottom. The sides are cut to form two wide steps, and water plants are grown on sand on the steps and bottom to protect the young fish from destruction by the old ones. Pipes enable the water in the pit to be changed, and holes are made in the ice forming on the surface in winter.

Lloyd (Ll.). **Materials for a Study in Animal Competition. Part III. The seasonal Rhythm of *Psychoda alternata* Say and an Effect of intraspecific Competition.**—*Ann. appl. Biol.* **30** no. 4 pp. 358–364, 1 fig., 7 refs. London, 1943.

The behaviour of *Psychoda alternata*, Say, has been studied in sewage bacteria beds at Knostrop, Leeds, where competition with other sewage flies is intense [*R.A.E.*, B **28** 150; **31** 181, etc.], at Barnsley, where the successful species are fewer [**26** 113] and at Huddersfield, where *P. alternata* is almost the only species, owing to the large amount of chemical wastes in the sewage [**29** 63]. Records of its seasonal incidence at Huddersfield, as observed in weekly trappings over 31 months in 1939–42, are given, together with the weekly bed temperatures and also the proportion of solids in the final effluent for the last 13 months. *P. alternata* comprised 98 per cent. of the total insect catch. It is essentially a summer species of crepuscular habits, but it can mate and complete its life-cycle in total darkness [**26** 114] and breeds at a reduced rate throughout the winter. It does not appear at the surface of the beds in the cold months at Knostrop or Barnsley, but can be trapped in small numbers in most weeks at Huddersfield, where there is no competition and the beds are slightly warmer. The relation between observed and estimated incidence is discussed. The actual rate of development was slightly lower than the estimated rate. There are peak periods of emergence explained on the basis of a theory that there are two alternating successions of generations as in *Spaniotoma minima*, Mg. [**30** 78], due to irregularities in the rising spring temperature, which tend to form peaks, and irregularities in the autumn cooling, which tend to split them. In the summer, when cycles were rapid, low peaks of emergence tended to alternate with high ones as a result of depletion of the food supply (chiefly *Oospora*) by larvae of the preceding generation, so that a sequence of over-population, depleted bed, population decline, food recovery and population recovery was set up. As cold prevents much increase in the fungus in winter when larvae are relatively inactive, growth is thick only in spring. The periodic depletion of food probably retarded larval development. The wing length of females was determined weekly for two years, and flies were found to be smaller in summer than in winter [**29** 63], but, in general, there was no correlation between size and

population pressure as indicated by emerging flies. Intraspecific competition influenced numbers far more than individual size. The discharge of solids from the bed in the final effluent was also studied in relation to the abundance of the fly. These solids consist of fragments of film loosened from the medium, the dejecta of grazing organisms, cast skins, dead insects, etc. There is a heavy discharge in spring when the accumulated growth of winter is being broken down by the rapidly increasing activity of the grazing larvae, and spasmodic fluctuations occur throughout the year. Although these are pronounced during winter when few larvae can be found in the bed, they are attributed to alternations in larval abundance. There must be many larvae in the bed in winter to give rise to the large adult emergence in spring.

MATTHYSSE (J. G.) & SCHWARDT (H. H.). **Substitutes for Rotenone in Cattle Louse Control.**—*J. econ. Ent.* **36** no. 5 pp. 718–720, 2 figs., 1 ref. Menasha, Wis., 1943.

Tests were made in 1941–43 of the effectiveness of certain dusts in the control of *Damalinia* (*Bovicola*) *bovis*, L., *Linognathus vituli*, L., *Solenopotes capillatus*, End., and *Haematopinus eurysternus*, Nitzsch, on cattle in New York, where, as in other parts of the north-eastern United States, lice are serious pests of dairy herds in winter and early spring. A mixture of 1 part cubé (5 per cent. rotenone) and 10 parts wettable sulphur was found to give excellent control of all species in 1941–42. In the following winter, various substitutes were tested as rotenone-bearing dusts are difficult to obtain. The usual dose was 3–4 oz. per animal, applied with a puff duster having a wide nozzle and canvas flaps to help confine the dust. The best results were obtained with a dust of 1 part finely ground sabadilla seed to 10 parts wettable sulphur, which gave complete kill of three species and 95 per cent. kill of *S. capillatus* in 7 days. Ground seed of the yam bean, *Pachyrhizus erosus* [*cf. R.A.E.*, A **31** 502] at the same strength was almost as effective. In neither case was there appreciable reinfestation within 3 weeks. Even at 1 : 20, sabadilla gave practically perfect control of all lice except *S. capillatus*. Thanite (secondary terpene alcohol thiocyanate) and lethane (beta-thiocyanoethyl esters of fatty acids), each at 1 part to 2 parts Celite and 8 parts sulphur gave 60–95 per cent. kill. *S. capillatus* was particularly resistant to them. Dusts that were ineffective at 1 part to 10 parts sulphur comprised proprietary free or fixed nicotines (Black Leaf 10 or 155) [but *cf.* B **32** 100], pyrethrum (Stimtox A) and hellebore. Velsicol (isomeric mixture of alkyl substituted naphthalenes) at 1 part to 2·5 parts Celite and 7·5 parts sulphur gave poor kills in 7 days, but good control over a longer period. Laboratory tests in which 10–15 females of *D. bovis* were placed on uniform deposits of the dusts confirmed the results of the field trials. Sabadilla was second in toxicity to rotenone, and nicotine only slightly better than sulphur. The only discrepancy in the results was in the case of yam-bean seed, which was only slightly toxic in the laboratory tests. This may be because its action is slow.

MCGOVRAN (E. R.), FALES (J. H.) & PIQUETT (P. G.). **The relative Resistance of *Periplaneta americana* and *Blattella germanica* to Pyrethrum Spray.**—*J. econ. Ent.* **36** no. 5 pp. 732–733, 5 refs. Menasha, Wis., 1943.

The following is the authors' summary. A pyrethrum spray that contained 5 mg. pyrethrins per ml. deodorised kerosene was applied by the pendulum method [*R.A.E.*, B **30** 194] as a direct spray to the dorsal surface of reared cockroaches. Adult females and large nymphs of *Blattella germanica*, L., were knocked down more rapidly than similar stages of *Periplaneta americana*, L., but mortality counts showed that *B. germanica* was more resistant to the lethal effect of the spray. Twice the deposit applied to *P. americana* caused only slightly higher mortalities when applied to *B. germanica*.

TREMBLEY (H. L.). **Derris used for the Control of Head Lice and Pubic Lice.**—*J. econ. Ent.* **36** no. 5 p. 795. Menasha, Wis., 1943.

In preliminary trials carried out over a period of several years under the direction of F. C. Bishopp, derris powder applied thoroughly but sparingly two or three times at intervals of 5–6 days and left on overnight gave satisfactory control in some 25 cases of infestation by *Pediculus humanus capitis*, Deg., (*P. h. humanus*, L.) and a similar number of cases of infestation by *Phthirus pubis*, L.; in only one instance was severe irritation reported. In 1937, the author and the late J. L. Webb tested derris powder containing 3 per cent. rotenone applied at the rate of one teaspoonful per head and a derris shampoo [*R.A.E.*, B **30** 193] on children and found both to be satisfactory. The powder was the more convenient except when crusts were present. It was left on for 10 days. The excess water was removed with a towel after shampooing, but the hair was not rubbed nor was it washed again for two weeks. The derris did not kill eggs but it killed the young lice as they hatched. Hats were also treated with derris. The work was continued until 1940, and the method was used again in a clinic opened in February 1942. In view of the effectiveness of the treatment, the children were allowed to return to school as soon as the powder had been applied.

GRAHAM (L. T.) & TATE (H. D.). **Nebraska Cattle Grub Survey.**—*J. econ. Ent.* **36** no. 5 pp. 801–802. Menasha, Wis., 1943.

Of 26,776 cattle comprising 826 lots examined at Omaha, Nebraska, in 1943 for infestation with cattle grubs [*Hypoderma*], 85 per cent. harboured at least one larva and 61 per cent. harboured five or more. No single lot was free from infestation. The animals came from various parts of the Middle West and West. Of 1,843 cattle comprising 60 lots from all parts of Nebraska, 92 per cent. had at least one larva and 64 per cent. at least five.

MILLS (H. B.). **An Outbreak of the Snipe Fly** *Symphoromyia hirta*.—*J. econ. Ent.* **36** no. 5 p. 806, 5 refs. Menasha, Wis., 1943.

Symphoromyia hirta, Johnson, was extremely abundant in the mountains of south-western Montana in 1943. The females occasionally bite man savagely, usually on the wrist, hand or neck, leaving a drop of blood at the wound, and the flies also cause considerable annoyance on account of their abundance, persistence and lethargic action after settling [*cf. R.A.E.*, B **29** 40]. When a gust of wind passed, they alighted on the back and shoulders in very large numbers. The numbers of the fly had greatly diminished by 7th August, and none was seen on the 19th. It was never found at altitudes of less than 5,000 ft. Brief protection was obtained from the liberal use of citronella oil, and tobacco smoke kept the flies off the face to some extent.

WILSON (S. G.). **Cattle Ticks and their Control by Dipping in Nyasaland.**—*Nyasaland agric. quart. J.* **3** no. 4 pp. 15–24. Blantyre, 1943.

A list of the seven species of Ixodid ticks that are common on cattle and other animals in Nyasaland, showing the diseases that they transmit, is followed by instructions for controlling infestations on cattle by the use of arsenical dips, combined with hand-dressing and clipping of long hairs on the ears and tail and under the tail. Where eradication is aimed at, these measures should be supplemented by fencing. Methods of testing the strength of a dip, precautions to be taken in using arsenical dips, and the signs and treatment of arsenical poisoning in cattle are also dealt with. Some ticks appear to have a certain resistance to arsenic, and 0·04 per cent. nicotine may be added to the dip [*cf. R.A.E.*, B **31** 122] to control these. As the cost of nicotine sulphate for this purpose would be great, instructions are given for using waste tobacco leaves.

Du Toit (R.) & Mönnig (H. O.). **An unusual Site of Attachment for Ticks.**—*J. S. Afr. vet. med. Ass.* **13** no. 3 pp. 79–80. Pretoria, 1942. [Recd. 1944.]

The owner of a farm in a part of the Transvaal where heartwater [*Rickettsia ruminantium*] is prevalent observed ticks in the mouths of several cows in the course of a few months when giving them bone meal by hand. In February 1942, one of these cows was examined on the day on which it had been found to be infested; it had a living and apparently normal adult male of *Hyalomma impressum*, Koch, firmly attached to the mucous membrane of the hard palate. The farmer stated that the ticks he had previously found had included several examples of *Amblyomma hebraeum*, Koch, the vector of heartwater; none had been engorged but all were firmly attached and living when removed. Ticks in the mouths of cattle would not be exposed to the usual control measures and might transmit heartwater if they began to feed, but it is unlikely that the females could complete engorgement, as, when distended with blood, they would probably be crushed during mastication and rumination.

Itch in Sheep due to Infestation with a Skin Mite *Psorergates ovis*.—*J. Dep. Agric. S. Aust.* **47** no. 3 pp. 122–124, 1 fig. Adelaide, 1943.

In view of the discovery of *Psorergates ovis*, Womersley, on sheep in northern and south-eastern districts of South Australia in 1943 and the possibility that it occurs in other parts of the State, notes are given on the appearance and behaviour of infested sheep, the rate of spread on the body and methods of diagnosis [*R.A.E.*, B **30** 140] and on treatment with lime-sulphur dips [**31** 249; **32** 81]. It is recommended that sheep should be dipped as soon as possible after shearing and in any case within 4–6 weeks, and that the dip should have an initial polysulphide content of about 1 per cent. and contain 6 oz. Agral per 100 gals. as wetting agent. Saturation of the fleece is complete in 30 seconds if Agral is used, but requires 2–4 times as long without it and so is difficult to obtain in the wool about the head.

Torrealba (J. F.). **Investigaciones sobre enfermedad de Chagas en el Estado Guárico, Venezuela.** [Investigations on Chagas' Disease in the State of Guárico, Venezuela.]—*Gac. méd. Caracas* **50** no. 1 pp. 3–4. Caracas, 1943.

Various batches of *Rhodnius prolixus*, Stål, taken between 1939 and 1942 inclusive in and near houses in mountain and savannah zones of a district in the State of Guárico, were found to include 48–100 per cent. of individuals infected with *Trypanosoma* (*Schizotrypanum*) *cruzi*. *Triatoma* (*Eutriatoma*) *maculata*, Erichs., *Panstrongylus geniculatus*, Latr., and *Psammolestes arthuri*, Pinto (the last from the nest of a bird), were also taken but were not infected. Data are given on two acute cases of Chagas' disease that occurred in a dwelling in which Triatomids were present. *Cebus apelle*, which has long been known to be easy to infect with *Trypanosoma cruzi* in the laboratory, was found infected in nature.

Iriarte (D. R.). **El carate en Venezuela.**—*Rev. Med. trop. Parasit.* **8** no. 6 pp. 75–81, **9** no. 1 pp. 1–7, 12 figs. Havana, 1942 & 1943.

The author reviews the distribution in America of the disease known in Venezuela as carate and evidence that has led him to agree with the view that it is caused by *Spirochaeta* (*Treponema*) *caratea* [*cf. R.A.E.*, B **27** 195]. It appears to be spreading in Venezuela, where there are a principal focus and five subsidiary foci and where the spirochaete has been found in man. The method of transmission is discussed. The infection is locally believed to be carried by certain flies, samples of which from three different foci proved to be species of *Simulium*, in one case *S. exiguum*, Roub. Spirochaetes are said to have been found in Simuliids in infected zones in Mexico. The pathology and treatment of the disease are dealt with at some length in the second half of the paper.

DALMAT (H. T.). **A Contribution to the Knowledge of the Rodent Warble Flies (Cuterebridae).**—*J. Parasit.* **29** no. 5 pp. 311–318, 2 figs., 11 refs. Lancaster, Pa., 1943.

Cuterebra spp. infest rodents in North and South America and are also commonly found on cats and dogs in the United States. A few cases of infestation have been recorded from opossums, donkeys and pigs [*cf. R.A.E.*, B **25** 219] and one from man. An account is given of observations in Iowa in 1940 and 1941 on *Cuterebra peromysci*, Dalmat [**30** 144], on the northern white-footed mouse (*Peromyscus leucopus noveboracensis*). In 1940, traps were set daily from early summer to mid-winter and many mice were caught, but the only ones infested were 25 of the 68 taken between 15th September and 2nd November and one taken on 4th August. In 1941, 54 per cent. of the mice trapped bore larvae. Infestation was highly localised and was almost confined to an area of about four acres, while similar types of land about 500 yards away with numerous mice yielded no infested ones. Larvae were usually in the inguinal region, and all had the posterior spiracular plates exposed. Several mice harboured 3–5 larvae and one bore 7. Infested animals were awkward and easily caught by predators, emasculation of male mice usually resulted from the presence of more than one larva, and about 20 per cent. of the infested mice were found dead in their cages when the larvae began to emerge. Although a thorough internal examination was made of 50 infested mice, larvae, which were in all stages of development, were found under the skin only. When the larvae left the host, they were placed on earth, and puparia were formed within two days at a depth of 1½–5 inches. The pupae overwintered in soil with a temperature of 25–41°F. A female and a male emerged from overwintered puparia on 31st May and 1st June 1941 and another male on 21st August. The behaviour of the first two was observed for a few days in a cage containing mice and their burrows; they were often seen near the entrance to the burrows, but did not appear to be attracted to the mice. Of adults obtained in 1942 from puparia collected the previous year, one contained about 450 eggs and another deposited a similar number on twigs and paper over a period of about 45 hours, beginning two days after emergence.

The way in which larvae of *Cuterebra* enter the host is discussed with reference to the literature [**6** 166; **8** 108; **13** 101], and the author concludes as a result of his observations, and because of the large number of eggs laid by some species, the length of the time for which they remain viable, the viability and activity of the young larvae, and the infestation of suckling young, that the eggs, which have a heavy chorion, are probably deposited in the nests or burrows of the hosts [**3** 194] and do not develop until some time later, and that the young larvae wait for hosts through the skin of which they enter. Various workers have judged the larval period of *Cuterebra* to be about a month. The pupal period of *C. peromysci* was 8–10½ months for larvae taken between September and November and less than 2½ months for a larva taken in mid-July. It is generally agreed that *Cuterebra* spp. overwinter as pupae in North America and have only one generation a year, but data are given in support of the belief that they may also overwinter as eggs and go through two generations. Evidence is adduced indicating that infestation reduces rodent populations considerably, and showing harmful effects on domestic cats, dogs and rabbits and experimental rodents.

THOMAS (H. D.). **Preliminary Studies on the Physiology of *Aëdes aegypti* (Diptera : Culicidae). I. The Hatching of the Eggs under sterile Conditions.**—*J. Parasit.* **29** no. 5 pp. 324–328, 10 refs. Lancaster, Pa., 1943.

Varied methods used in the past to culture eggs of *Aëdes aegypti*, L., under sterile conditions have given inconsistent results as to the influence of living

micro-organisms on hatching [*R.A.E.*, B **5** 156; **15** 93, 161; **16** 120; **17** 183; **18** 234]. In the author's experiments the surfaces of recently laid eggs that had been kept moist were sterilised by a method described and transferred to individual culture tubes containing 5 ml. of the medium to be tested. Only one out of 84 eggs hatched by the end of the fifth day of incubation in sterile nutrient broth, but 26 out of 38 that were then exposed to contamination from the air hatched by the end of the eighth day, while no further hatching occurred in the tubes that were kept sterile. Only one out of 20 eggs placed in 5 ml. of a 0·5 per cent. solution of liver extract had hatched by the end of the fifth day; 8 out of 10 that were then exposed to contamination hatched by the end of the eighth day, while no further hatching occurred in the sterile tubes. Ten eggs that were taken at the end of the fifth day from sterile tubes of nutrient broth and placed in an autoclaved 1 per cent. suspension of brewer's yeast in a 0·5 per cent. solution of liver extract also failed to hatch by the end of the eighth day. Pure cultures of 14 species of bacteria, yeasts and moulds stimulated the hatching of 63–100 per cent. of eggs that had previously been left dormant in sterile nutrient broth for 5 days, and it is concluded that the ability to stimulate hatching is probably generally distributed among heterotrophic fungi. Hatching under sterile conditions, however, was stimulated by crowding the eggs, the percentages that hatched in comparative experiments increasing from 6 when there was one egg per tube and 21 when there were two to a maximum of 80–84 when there were 53–64. This may explain the failure of some workers to find any correlation between the presence of living micro-organisms and hatching.

PHILIP (C. B.). **Flowers as a suggested Source of Mosquitoes during Encephalitis Studies, and incidental Mosquito Records in the Dakotas in 1941.**—*J. Parasit.* **29** no. 5 pp. 328–329. Lancaster, Pa., 1943.

It was found that some of the species of mosquitos required for tests on the presence of encephalitis virus in connection with an outbreak that occurred in North and South Dakota in 1941 could be obtained as readily from flowers as by other methods. Certain flowers, such as goldenrod (*Solidago*), were visited extensively not only by males and young females but also during both day and night by females with blood meals in various stages of digestion and even with abdomens distended with eggs. The species collected from goldenrod included *Aëdes vexans*, Mg., *A. spenceri*, Theo., *A. campestris*, D. & K., *Culex tarsalis*, Coq., *C. territans*, Wlk., and *Theobaldia inornata*, Will. The only important biting species of the district that were almost unrepresented were the Anophelines. Collections were easily made with an aspirator, even in wet, cool weather, and mosquitos could be taken by the light of a torch on the younger blossoms late in the season when the night temperatures were approaching freezing point.

Anopheles maculipennis, Mg., was found in some abundance in certain localities in central and eastern North Dakota and in north-eastern South Dakota, but with one exception not on flowers; *A. punctipennis*, Say, was less common [*cf. R.A.E.*, B **30** 37]. Two individuals of *A. quadrimaculatus*, Say, were seen at Valley City in eastern North Dakota, and one of them was caught. The recorded north-westernly limit for this species was previously in eastern Minnesota. Other mosquitos taken included *Culex pipiens*, L., in South Dakota, and *C. territans* and *C. tarsalis* in North Dakota. In the earlier collections, *Aëdes vexans* and *A. dorsalis*, Mg., were the most abundant mosquitos on domestic stock, but rain in the middle of September resulted in the emergence of very large numbers of *A. spenceri*, which then became the dominant pest of man and domestic animals. This observation is of interest, as *A. spenceri* is reported to have only one generation a year, with overwintering

eggs and adults emerging in spring, though the adults may persist throughout the summer.

HURLBUT (H. S.). **Observations on the Use of Sea Water in the Control of *Anopheles albimanus* Wied.**—*J. Parasit.* **29** no. 5 pp. 356–360, 3 refs. Lancaster, Pa., 1943.

An account is given of investigations on the concentration of sea water necessary to control *Anopheles albimanus*, Wied. [*cf. R.A.E.*, B **21** 182] in brackish landlocked coastal lagoons in Porto Rico, where it breeds prolifically, and on the means of maintaining this concentration. The principal criterion chosen for determining the limiting effect of sea water on development was the percentage hatch. The percentages of isolated, gravid females that oviposited when given the opportunity to do so in distilled water and sea water diluted to concentrations of 25, 50, 75 and 80 per cent. were 33·3, 31·1, 15·4, 20·3 and 10·5, respectively, the average percentages of eggs that hatched per batch when left in these different types of water for 7 days at about 80°F. were 65·5, 33·1, 7·7, 6·6 and 0·33, and the percentages of batches that were infertile were 20, 3, 30, 73 and 89. The average number of eggs per batch did not appear to be significantly affected by the salt concentration. The results of two tests in which eggs from single batches deposited on distilled water were divided after 5–15 hours and distributed on 66, 75, 80 and 100 per cent. sea water indicated that the lethal concentration of sea water lay between 66 and 80 per cent. The immature stages were able to complete development in up to 75 per cent. sea water, but very few did so at this concentration. When larvae were removed from a brackish water breeding place (about 25 per cent. sea water) while in the first instar and placed in 25, 50, 75, 80 and 90 per cent. sea water, 65, 6, 18, 12 and 0 per cent. reached the adult stage, respectively.

Details are given of observations made almost daily from 10th October to 18th November in a lagoon that had just been connected with the sea. They were in general agreement with the laboratory results. Practically no first-instar larvae were seen after 20th October, when the concentration of sea water had risen from 15 to 65 per cent., but the larvae present continued to develop and an observable number reached maturity even though the percentage sea water by the time they did so exceeded 80. Continued dipping indicated that production of *A. albimanus* had been virtually eliminated. When the sea-water content remained between 15 and 25 per cent., before connection with the sea had been established, *A. albimanus* had been abundant, while no larvae were taken in an adjacent lagoon with a sea-water content of 70–80 per cent. due to connection with the sea. Tidal action in the formerly land-locked lagoon maintained a sea-water content of 80–90 per cent. This was restored in about a week after a heavy rainfall had reduced the concentration to about 5 per cent. Fluctuation of water level and the changes effected in the flora were probably added factors in reducing breeding. It is considered desirable in practice to maintain a salinity high enough to allow an adequate margin above the point where active breeding ceases, and 75 per cent. sea water is thought suitable.

ADAMS (C. F.) & GORDON (W. M.). **Notes on Mosquitoes of Missouri (Diptera : Culicidae).**—*Ent. News* **54** no. 9 pp. 232–235. Lancaster, Pa., 1943.

In view of the serious epidemic of encephalitis that occurred in the St. Louis area [*cf. R.A.E.*, B **24** 253] and the wide distribution of malaria in Missouri, a list is given of 29 species of mosquitos that have been taken there and one (*Aëdes dorsalis*, Mg.) taken in Illinois 4–5 miles from the Missouri border. The dates (month and usually day) and places of capture of each are given. The species of *Anopheles* are *A. quadrimaculatus*, Say, and *A. punctipennis*, Say.

HAMMON (W. McD.), REEVES (W. C.) & GRAY (M.). **Mosquito Vectors and inapparent Animal Reservoirs of St. Louis and Western Equine Encephalitis Viruses.**—*Amer. J. publ. Hlth* **33** no. 3 pp. 201–207, 47 refs. Albany, N.Y., 1943.

It is concluded from a review of the literature on the transmission of St. Louis encephalitis and western equine encephalitis that, at least in the Yakima Valley, Washington [*R.A.E.*, B **29** 194; **30** 190; **31** 73], both viruses seem to be transmitted by mosquitos and that the source of infection in the mosquitos must be a very large inapparent vertebrate reservoir, probably chiefly among domestic fowls. As all known vertebrate infections have been short and laboratory infections in mosquitos have occasionally been lifelong, a mosquito that overwinters in the adult stage, such as *Culex tarsalis*, Coq., in the Yakima Valley, is considered a likely vector. *C. tarsalis* moreover has been found infected with both viruses in nature [**31** 73], frequents dwellings and feeds readily on domestic fowls. In tests of its ability to acquire infection from fowls and transmit it to them, mosquitos and fowls were confined in a temporary field laboratory in Yakima during the epidemic season in the summer of 1942. The St. Louis virus was repeatedly transmitted from fowls to fowls and from ducks to fowls after an incubation period in the mosquito of 8–16 days at 78–90°F. and about 85 per cent. relative humidity. *C. tarsalis* also transmitted the western equine virus from a duck and guineapigs to fowls after incubation periods of 10–19 days and transmitted it repeatedly to fowls after acquiring it by feeding on blood-virus suspension. In addition to *Culex pipiens*, L. [*cf.* **30** 162], *C. coronator*, D. & K. [**31** 50] and *Aëdes lateralis*, Mg. [**31** 74], *A. taeniorhynchus*, Wied., *A. vexans*, Mg., and *Theobaldia incidens*, Thos., transmitted the St. Louis infection after feeding on blood-virus suspensions, and *T. incidens*, infected in the same way, also transmitted the western equine virus.

The results given are thought to confirm that *C. tarsalis* is the vector and that fowls are the reservoir in the Yakima Valley, but the probability that this does not apply in other foci is stressed. It appears that control should be directed against mosquitos, with vaccination against the western equine virus in special circumstances. A vaccine for the St. Louis virus is not yet available.

The classification "Arthropod-borne virus encephalitides" is suggested to include St. Louis encephalitis, western and eastern equine encephalitis, Japanese B encephalitis [**32** 2–4] and Russian spring-summer (tick-borne) encephalitis. The name is selected to avoid confusion with forms of infectious encephalitis that are not Arthropod-borne, such as rabies, or are not caused by a virus, such as sleeping sickness (African trypanosomiasis).

[Papers on Mosquito Control.]—*Mosq. News* **3** no. 3 pp. 96–118, 5 figs. New Brunswick, N.J., 1943.

In the first of these papers, "World Wide Mosquito Control," by H. L. Felton (pp. 96–104), the advantages and disadvantages of Paris green dust, an emulsion of oil containing pyrethrum extract [*R.A.E.*, B **23** 205] and petroleum oils for the control of mosquito larvae are set out, and notes are given on their application. A petroleum oil should contain enough of a low-boiling petroleum fraction to insure quick penetration into the respiratory system and high toxicity, and enough of a high-boiling fraction to leave a relatively stable film. The ideal oil is of the light distillate fuel or diesel type, with a gravity (A.P.I.) of 27–33, a flash point of 130°F. or higher, a viscosity S.U. at 100°F. of 35–40, and a distillation percentage of 10 (the killing fraction) at 430–450°F., 50 at 510–550°F., and 90 (the lasting fraction) at 630°F. or higher. Waste crankcase oils are stated to have been found unsatisfactory.

In "Crude Oil used for Mosquito Control" (pp. 111–112), W. M. Gordon states that crude oil is being used successfully for the control of mosquitos in

Texas. Its specifications are compared with those of the ideal oil. It is of the crude-distillate type with a gravity of 42·5, a flash point of 100°F., a viscosity of 34, and a distillation percentage of 10, 50 and 90 at 444, 497 and 590°F. It is highly toxic to larvae and pupae, spreads rapidly and makes a lasting film on either fresh or saline water. It is distributed by a decontamination unit consisting of a solution tank, pump and motor.

The other papers include "Ditching with Dynamite for Mosquito Control," by J. I. Horty (pp. 112–113), in which it is pointed out that blasting with dynamite is a cheaper, quicker and more effective and labour-saving method of making ditches than digging, particularly in wet or marshy ground and that it leaves no banks to hinder drainage, and "References to Literature on Mosquitoes and their Control," by H. H. Stage (pp. 113–118).

RENN (C. E.). **Emergent Vegetation, mechanical Properties of the Water Surface, and Distribution of *Anopheles* Larvae.**—*J. nat. Malar. Soc.* **2** no. 1 pp. 47–52, 3 figs. Tallahassee, Fla., 1943.

To determine the mechanism responsible for the attractiveness of emergent vegetation to larvae of *Anopheles quadrimaculatus*, Say, observations were made on the behaviour of larvae and larva-sized boat-shaped pieces of metal foil or cellophane, bent upwards at one end and downwards at the other, in pans of water in which a patch of weeds was simulated by a group of glass rods. The rods had the mechanical effect of plants in that each rod deflected the surface of the water upwards or downwards, producing either a positive or negative meniscus according to whether it was wettable or not. Most emergent plants produce positive menisci, but a few are waxy before they become coated with slime. About three-quarters of the surface of the water in each pan was flat and the rest sloped upwards or downwards, the change occurring at a distance of 9 mm. from the rods and the walls of the pan. It was found that Anopheline larvae swimming or floating near rods are suddenly drawn into the menisci when they approach nearer than 9 mm. The tail swings sharply towards a wettable rod and the larva glides with increasing speed up the slope of the meniscus. Larvae that move into positive menisci head-first usually swing round to the reverse position. Gentle wind and light currents are inadequate to dislodge them once they are in the meniscus. About negative menisci, larvae orient themselves parallel to the curve of the upper surface. The forces involved were demonstrated by the use of the models, as the upturned end of the model supported a positive meniscus and the depressed end formed a negative one. When a model was placed on the water near a wetted rod, the upturned end was attracted to the rod and the depressed one repelled, but if it approached a waxy rod with a negative meniscus, the depressed end was attracted and the upturned one repelled. The forces involved are the simple ones common to surfaces under tension and tending to maintain a minimum surface area. A larva of *A. quadrimaculatus* normally rests with its dorsal side uppermost. Some parts resist wetting, but the posterior borders of the spiracular plate wet readily. When the plate is tilted forwards, the wetted posterior border is raised slightly above the surface and a positive meniscus is formed. The tail-borne positive meniscus is forced towards the apex of the positive meniscus round the stem of a plant by the forces maintaining minimum surface area. The distribution of larvae over flat and sloping surfaces in various trials in the artificial weed patch is shown in tables.

GOODWIN jr. (M. H.) & LENERT (L. G.). **Methods used for investigating certain hydrologic Problems related to Malaria.**—*J. nat. Malar. Soc.* **2** no. 1 pp. 63–72, 5 figs., 21 refs. Tallahassee, Fla., 1943.

Descriptions are given of three types of depressions that develop in the extensive limestone formations of the malarious regions in the south-eastern

United States, where the vector of the disease is *Anopheles quadrimaculatus*, Say [*cf. R.A.E.*, B **21** 148 ; **25** 187]. The relation of ponds in which *A. quadrimaculatus* breeds to precipitation and ground water and methods of collecting hydrological data concerning the occurrence of these ponds by measurements of rainfall, run-off, ground water and pond levels, and evaporation are then discussed. With the exception of evaporation measurements, which are inaccurate and are not deemed essential, the methods have all been used for three years at a field station in south-western Georgia.

[**Mosquito Control Work in 1942.**]—*Proc. N. J. Mosq. Ext. Ass.* **30** 244 pp., 13 pls., text ill., refs. New Brunswick, N.J., 1943.

In addition to accounts of mosquito situations and control work in various parts of the United States, which are primarily of local interest, have particular reference to the army and conditions brought about by war, or contain information that has been noticed from other sources, this report, which is similar in arrangement to previous ones [*R.A.E.*, B **30** 187], includes a review of mosquito work throughout the world in 1942, by F. C. Bishopp and H. H. Stage, and papers on mosquito suppression work in Canada, by L. S. McLaine, the anti-mosquito campaign in Bermuda [**32** 34], by H. Wilkinson, the results of 10 years of mosquito trapping in New Jersey, by T. J. Headlee, 23 years' experience in malaria control in the Panama Canal Zone, by D. P. Curry, and aerosol sprays for killing and repelling mosquitos, by J. M. Ginsburg, in which the various methods and apparatus used in producing and applying aerosols to kill and repel adult mosquitos and other insects are described and the properties of aerosols in general are discussed.

In " Notes on *Anopheles occidentalis* in central New York," by R. Matheson & J. Belkin (pp. 7–11), it is recorded that many adults of *Anopheles maculipennis* var. *occidentalis*, D. & K., were found close to Cayuta Lake near Ithaca in central New York at an altitude of 1,272 ft. between April and November 1942. Large numbers of females were caught while attempting to bite, sometimes in bright sunlight, and others, some of which had fed recently, in buildings of various types. Records are also given of other mosquitos taken, which included *A. quadrimaculatus*, Say, and *A. punctipennis*, Say. *A. maculipennis* var. *occidentalis* had apparently never previously been found in New York State south of the Adirondacks. Larvae were taken in very small numbers in May and September, and two pupae in May.

In " The Breeding of *Anopheles crucians* in highly acid Waters in abandoned Clay Pits in Middlesex County, New Jersey " (pp. 11–16, 4 refs.), J. B. Schmitt states that in September 1942, larvae of *Anopheles crucians*, Wied., were found in New Jersey in pools in abandoned clay pits in which the pH of the water ranged from 3·3 to 4·7 with a mean of 3·75 [*cf.* **31** 121]. The acidity appeared to be due to selective adsorption by the clay of salts in solution. The acidity of individual pools was very constant. One large pool abandoned for more than 35 years still had a pH of 3·7, and the only mosquito larvae in it were apparently *A. crucians*. It is thought, therefore, that the pools are not likely to become breeding places of *A. quadrimaculatus* for many years. The fact that some pools apparently identical with those in which *A. crucians* was found contained no larvae is unexplained. Larvae transferred to water obtained from them developed quite well. Eggs of *Culex pipiens*, L., placed in water from the clay pools either did not hatch or gave rise to larvae that died on the first day, and third-instar larvae transferred to it also died.

" Density of *Anopheles quadrimaculatus* as related to Prevalence of Malaria," by L. L. Williams, jr. (pp. 17–20, 2 refs.), deals with the modifying effect of local conditions and the habits of the population on the ability of a considerable vector density to cause serious malaria rates. The good effect of screening in Arkansas and New Jersey and the significance of lack of continuity in abundance

of *A. quadrimaculatus* at any one point of observation are pointed out. It is concluded that the introduction of a few hundred malaria carriers into New Jersey is not likely to start more than small, circumscribed outbreaks under the local conditions of housing, drainage, etc., which spontaneously reduced the former high rate. In the southern United States, control measures are initiated about military camps and the sites of war industries wherever *A. quadrimaculatus* is known to be present and malaria has recently occurred, and the work is continued until the mosquito becomes difficult to find, but further north, control measures are not considered to be justified unless special conditions indicate that they are desirable.

In " Density of *Anopheles quadrimaculatus* and the Prevalence of Malaria," by G. H. Bradley (pp. 20–21), those desiring to make statistical analyses of factors bearing on the density of Anophelines in relation to malaria are referred to Sir Ronald Ross' book " The Prevention of Malaria " (London, 1910), and the conditions required for the production of new infections in a locality are quoted from it.

The relative merits of counting adults in natural or artificial resting places [*cf.* **31** 52, 217] and of operating New Jersey light-traps to estimate population densities of *A. quadrimaculatus* are discussed by Bradley in " Determination of Densities of Populations of *Anopheles quadrimaculatus* on the Wing " (pp. 22–27, 2 refs.), with the conclusion that the first method is preferable, and by J. T. Hart, jr., in " Determining the Densities of Populations of *Anopheles quadrimaculatus* on the Wing by Light Traps, by Nail Kegs, by Resting Places, and by Resting and Feeding Places " (pp. 28–29), with the conclusion that any of the methods dealt with may be used, though to obtain as complete a picture as possible all known methods should be combined.

" Malaria Control along an Air Route through Africa," by L. T. Coggeshall (pp. 32–38), deals with the methods of malaria prevention used along the United States commercial airline for the transport of military personnel and equipment for the Allied Nations across Africa. Considerable success was obtained. Protection of the individual from mosquitos was the most effective factor, followed by other measures directed against *Anopheles gambiae*, Giles, the Anopheline concerned almost throughout. Suppressive prophylactic therapy is not recommended unless malaria is excessive, *Plasmodium falciparum* is predominant or control measures are difficult to enforce.

In " The Influence of Dry Weather on Mosquito Breeding " (pp. 73–74), R. E. Dorer shows the various ways in which the dry weather that prevailed in Virginia in 1940, 1941 and 1942 favoured breeding by *Anopheles quadrimaculatus* and impeded control, although mosquito production in general is greater in a wet season than a dry one.

LIVESAY (H. R.) & POLLARD (M.). **Laboratory Report on a clinical Syndrome referred to as " Bullis Fever."**—*Amer. J. trop. Med.* **23** no. 5 pp. 475–479, 1 graph, 2 refs. Baltimore, Md., 1943.

An account is given of laboratory investigations on a disease known as Bullis fever, lone star fever or Texas tick fever that occurred in 1942 and 1943 among soldiers at Camp Bullis, Texas, between April and the autumn. It has so far been associated with the bites of ticks or infestation by *Trombicula*. There was no evidence of immunological relationship between Bullis fever and Rocky Mountain spotted fever, and it is apparently not typhus or Q fever. There is no significant Weil-Felix reaction. A rickettsia-like agent from clinical cases was maintained in guineapigs and induced mild febrile reactions on the ninth to twelfth days without orchitis. It was observed in the hyperplastic lymph nodes of patients and in guineapigs killed during the febrile stage of the reaction. It is stated in a foot-note that infected Swiss mice show no signs

of the disease, though they contain many more rickettsiae than were found in the guineapigs. It is concluded that it is probably a previously undescribed syndrome caused by a rickettsia.

Inoculation into guineapigs of the supernatant fluid from a pool of 150 ticks (chiefly *Amblyomma americanum*, L., and including some *Haemaphysalis leporis-palustris*, Pack.) collected from Camp Bullis and triturated in saline resulted in a rise of temperature of one day's duration on the ninth day in one guineapig. Post-mortem examinations of deer infested with *Oestrus ovis*, L., and hares infested with *H. leporis-palustris* were negative.

SAMPAYO (R. R. L.). **Toxic Action of *Latrodectus mactans*' Bite and its Treatment. Clinical and experimental Studies.**—*Amer. J. trop. Med.* **23** no. 5 pp. 537–543, 37 refs. Baltimore, Md., 1943.

Lists are given of the species of *Latrodectus* and of those responsible for poisoning in man in various parts of the world. Cases of poisoning by *L. mactans*, F., are of common occurrence in Argentina ; the author has recorded about 300 in the provinces of Buenos Aires and Santiago del Estero, but this number does not indicate their actual frequency. Notes based on the literature and on extensive experiments by the author are given on the effect of the poison of *L. mactans* on various animals, and its effect on man is also described. Recommendations are made for the treatment of poisoning, including the use of a specific antitoxic serum [*R.A.E.*, B **31** 65].

ROBINSON (G. G.). **The Stability of Rotenone in a Phenol-oil Solution.**—*Bull. ent. Res.* **35** pt. 1 pp. 1–2, 4 refs. London, 1944.

Third-stage nymphs of *Ornithodoros moubata*, Murr., were sprayed with a year-old solution of 1·5 per cent. rotenone in xylenol, ground-nut oil and a petroleum oil (5 : 3 : 12) that had been stored in a dark but airy place and also with a similar solution freshly made. The method was similar to that used in earlier tests of the same spray [*R.A.E.*, B **31** 67]. The data, which were analysed statistically, show that the old solution was quite as toxic as the fresh one.

LUMSDEN (W. H. R.). *Anopheles hispaniola*, **Theobald, 1903 (Dipt., Culicid.) from the Emirate of Transjordan.**—*Bull. ent. Res.* **35** pt. 1 pp. 3–9, 10 refs. London, 1944.

Descriptions are given of the egg, fourth-instar larva, pupa and adults of both sexes of an Anopheline that was found to be widely distributed and often common in Transjordan in the summer and autumn of 1942 and could not be definitely separated from *Anopheles hispaniola*, Theo., or *A. italicus*, Raff., from the descriptions available to the author. He considers that *A. italicus* will probably prove to be a variety of *A. hispaniola* and that the Transjordan form is insufficiently different from the latter to merit more than varietal rank. It is generally distributed in south-western Transjordan in the wadis that drain into the Jordan-Wadi Araba rift valley, and its range extends to the borders of Saudi Arabia in the south, but it has not been taken in Palestine. It occurred at altitudes of about 1,300–3,800 ft. Larvae were found between 31st May and 28th October, mainly in algal mats in wadis and in foot-holes among seepage, but occasionally among stones and in small pools at the heads of springs. Adults were taken in stables in June and July, but not in houses. This Anopheline therefore conforms biologically to *A. hispaniola* in the western Mediterranean area. Most of the localities in which it was recorded are malarious, but as *A. superpictus*, Grassi, also occurs in them, its importance as a vector in Transjordan is uncertain.

NASH (T. A. M.). **The Control of Sleeping Sickness in the Raphia Pole Trade.**—*Bull. ent. Res.* **35** pt. 1 p. 49. London, 1944.

Many streams in Northern Nigeria are choked with a palm, *Raphia sudanica*, the mid-ribs of the fronds of which are gathered for roofing. The palm provides an excellent environment for *Glossina tachinoides*, Westw., and the incidence of sleeping sickness among cutters was often high. A system was therefore introduced in Zaria Province in January 1939 by which cutting is allowed only during the first 14 days of each quarter of the year. If a fly acquires the infection from one of the cutters, the trypanosomes cannot reach the infective stage in it until the cutting period is closed, and all or almost all the flies present during one period are dead before the next one begins. In previous experiments [*R.A.E.*, B **24** 239], the mean period of survival of *G. tachinoides* in a grass hut was under 50 days even in the cool season ; the longest periods recorded were 93 days for males and 116 for females in the hut, and 69 days for a marked fly in nature.

NASH (T. A. M.). **A low Density of Tsetse Flies associated with a high Incidence of Sleeping Sickness.**—*Bull. ent. Res.* **35** pt. 1 p. 51. London, 1944.

In view of the discovery of a high incidence of sleeping sickness in the Kudaru District of Zaria Emirate, Northern Nigeria, in 1935, the author made an entomological investigation in the late dry season with particular reference to a hamlet with an infection rate of 70 per cent. among the 43 inhabitants. This hamlet is situated above a stream that dries up after the rains. Exhaustive searching along its bed for some miles in each direction failed to reveal the presence of tsetse or of pools, but immediately below the hamlet at a place where the sand of the stream-bed was moist and a hole two feet deep had been scooped as the only source of water, four individuals of *Glossina palpalis*, R.-D., were caught. As about 15 minutes were required to fill a water pot, the tsetse population of probably less than a dozen flies could feed on the waiting people for many hours each day without expending energy in searching for food. The case is considered typical of the close man-fly contact commonly brought about by dry-season conditions in Northern Nigeria. High densities of *G. palpalis* or *G. tachinoides*, Westw., are rare in the dry season except along the main rivers in which water is much more plentiful.

FELDMAN-MUHSAM (B.). **Studies on the Ecology of the Levant House Fly (*Musca domestica vicina* Macq.).**—*Bull. ent. Res.* **35** pt. 1 pp. 53–67, 5 figs., 15 refs. London, 1944.

An account is given of experiments carried out in Jerusalem on the bionomics of *Musca domestica vicina*, Macq. All flies were bred in cow dung, which had proved to be the best of several media tried. Field and laboratory observations failed to yield evidence that the larvae left the dung to pupate. Numerous pupae were found near the surface of the dung at 10–23°C. [50–73·4°F.] in winter and 21–50°C. [69·8–122°F.] in summer. The sexes emerged in equal proportions in the laboratory, but in nature, males predominated in summer and females in winter. Data for all stages at three different temperatures were in agreement with the theory that the product of the duration of development and the effective temperature is constant [*cf. R.A.E.*, A **13** 389 ; **23** 296]. The thresholds of development of the egg, larval, pupal and pre-oviposition stages were 12·6, 8, 11·3 and 14°C. [54·68, 46·4, 52·34 and 57·2°F.] and their thermal constants were 7·4 hour-degrees C. [13·32 hour-degrees F.] and 132, 87 and 45 day-degrees C. [237·6, 156·6 and 81 day-degrees F.]. The maximum length of adult life in captivity was 106 days, and the average 20–30. Temperature had more influence than humidity on length of life, but the effect of higher temperature in shortening life was less marked at high than at low humidity.

Above 20°C. [68°F.], life was longest at a relative humidity of 42–55 per cent. Below 20°C., the flies were active, healthy and relatively long-lived at 30–40 per cent. relative humidity, and sluggish, feeble and short-lived at 80 per cent. At 27°C. [80·6°F.] and medium humidity, eggs were deposited in batches usually comprising 100–120, but sometimes 250, and the average number of batches per female was 2·6. The mean number of eggs deposited per day did not apparently affect the duration of adult life and did not change considerably during life.

No diapause occurs in any stage in Palestine. The number of hours' exposure to various low temperatures necessary to be lethal was determined for all stages and is shown in tables. The larvae were more resistant than other stages. Eggs were very sensitive to prolonged cold, but more resistant than other stages to intense cold for a short period. Certain peculiarities resulting from exposure to cold are described, including abnormal pupation, which is not followed by adult emergence. The winter in Palestine is never sufficiently cold to arrest development of the immature stages or kill adults, but large numbers of larvae and pupae are destroyed in their breeding places by excessive humidity, and oviposition is inhibited though the eggs mature in the ovaries.

DAVID (W. A. L.). **Fumigation as a Method of controlling the Body Louse, *Pediculus humanus corporis*, De Geer. Parts I and II.**—*Bull. ent. Res.* **35** pt. 1, pp. 79–89, 2 figs., 20 refs. London, 1944.

This paper consists of the first two parts of a series on experiments to find fumigants that will control *Pediculus humanus humanus*, L. (*P. h. corporis*, Deg.) on clothing more safely than hydrocyanic acid gas and with less cumbersome equipment than is required for heat treatment. The lice were fumigated in glass flasks in a constant temperature box. Details of the construction and operation of the apparatus used are given in the first part, and preliminary tests of 21 fumigants are dealt with in the second.

Dosages of 10, 50 and 100 mg. per litre or saturation concentration were applied to third-instar larvae and eggs. The results obtained and also data, mostly from the literature, on the physical and chemical properties of the substances that might have a bearing on the choice of a fumigant are shown in tables. The fumigants selected for practical trials [*cf. R.A.E.*, B **31** 212], followed in brackets by the ranges embracing the concentrations in mg. per litre required to kill all lice and all eggs with an exposure of one hour at 20°C. [68°F.], were ethyl formate, methyl formate and methallyl chloride (50–100, 100–saturation), all of which are comparatively harmless to man, ethylene dichloride (100–saturation, >saturation), which is very readily available and was satisfactory in five-hour tests, chlorpicrin (10, 10–50), which however requires too much care to be handled by inexperienced persons, and trichloracetonitrile (10–50, 50–100), which if it could be made available, would be preferable to chlorpicrin in the hands of trained operators, although it is highly lacrymatory. The objections to the rejected substances are indicated.

BUXTON (P. A.). **Temperatures lethal to the Louse.**—*Brit. med. J.* no. 4130 p. 341, 2 figs., 1 ref. London, 1940. [Recd. 1944.]

The results are given of experiments on the amount of heat required to kill body lice (*Pediculus humanus*, L.) and their eggs [*cf. R.A.E.*, B **29** 118], and the apparatus used, which enabled them to be exposed to precise temperature conditions in a test tube, is described. The lice were tested in batches of ten. The lowest temperatures that gave complete kill of larvae and adults of both sexes were 51·5, 49·5 and 46°C. [124·7, 121·1 and 114·8°F.] with exposures of 5, 10–30 and 45–60 minutes, respectively. Females exposed to temperatures just below the lethal ones laid infertile eggs. The lowest temperatures fatal to eggs less than five days old were 53·5, 52 and 50°C. [128·3, 125·6 and 122°F.]

with exposures of 5, 10 and 30 minutes, respectively, but lower temperatures were lethal to older eggs. Exposure to temperatures of 46–47°C. [114·8–116·6°F.] appeared to damage the embryo so that it failed to emerge from its shell, although it could complete its development. It is concluded that lice and their eggs would generally be killed by the ordinary process of washing cotton goods, but the temperatures to which woollen goods are normally subjected would not be high enough. Dry cleaning should be very effective as both the cleaning fluid (*e.g.*, carbon tetrachloride or petrol) and the temperature used in drying would almost certainly destroy lice and eggs [*cf.* **32** 74].

Rose (—). **Fortschritte in der Bekämpfung der Kleiderlaus.** [Progress in the Control of *Pediculus humanus*.]—*Reichs-Gesundheitsblatt* **18** no. 5 pp. 53–57. Berlin, 1943.

While acknowledging the advances that have been made during the present war in the use of inoculation against typhus, the author remains of the opinion that the control of lice [*Pediculus humanus*, L.] is still the principal factor in preventing typhus epidemics. He deprecates the considerable attention that has been given to the theory of transmission by means of dust bearing louse excreta, as he considers that many alleged cases of it are unproved, and it does not affect the main object of control, which is to free the population from lice and not merely to destroy infected lice on typhus patients, who are normally dealt with in hospital and not in public disinfestation centres. He then discusses various methods that have been or are in use in Germany for the control of lice. These include hot air treatment, preferably with provision for circulating the air, and fumigation with hydrocyanic acid gas, both of which are still in use, fumigation with a number of proprietary products, the constituents of which are not given, dry-cleaning, and the application to the body of various substances, including mixtures of pumice powder, petroleum oil and soft soap (3 : 2 : 1) or pumice powder, sodium carbonate and pure chalk (2 : 1 : 3), which have a physical as well as a chemical action, and methyl salicylate [*cf. R.A.E.*, B **31** 244], which is useful for application to body hair.

Green (R. G.), Evans (C. A.) & Larson (C. L.). **A ten-year Population Study of the Rabbit Tick** *Haemaphysalis leporis-palustris*.—*Amer. J. Hyg.* **38** no. 3 pp. 260–281, 3 figs., 11 refs. Lancaster, Pa., 1943.

The following is mainly based on the authors' summary. The important hosts of *Haemaphysalis leporis-palustris*, Pack., in the neighbourhood of Lake Alexander in Minnesota were found to be the cottontail rabbit [*Sylvilagus floridanus*], the ruffed grouse [*Bonasa umbellus*] and the snowshoe hare (*Lepus americanus*). Snowshoe hares carry an average of four times as many ticks as do cottontail rabbits and about twice as many as do ruffed grouse. As a result of the differences between the populations of these three hosts, the number of ticks on the rabbits and grouse is insignificant except in years when the population of snowshoe hares is at the low point in its cycle. At such times, up to 33 per cent. of all feeding ticks in the area may be on grouse. Ticks emerge from hibernation in the first half of April and are present on all snowshoe hares until October. During May, June and July, there are usually 500–2,500 ticks per hare. A rapid rise in the number of ticks, due to the hatching of larvae, occurs in August, and infestation remains high throughout September and into October. Most hares are free of ticks in November, but an occasional one has been found infested in December, January or even February.

The degree of infestation during May and June depends on the number of ticks present during the latter half of the preceding summer, but the degree of infestation during August and September is determined by the population of snowshoe hares during the preceding spring. An estimate of the number of

feeding ticks to the square mile was obtained by multiplying the number of hares by the average number of ticks per hare. From these data, it is shown that the changes in the population of the hares during the 10-year cycle are accompanied by much greater changes in the population of the tick. In September 1933, when the population of snowshoe hares was at the peak of its cycle, it was estimated that there were about 623 hares and 2,800,000 feeding ticks to the square mile. In September 1938, when the population was at the low point of the cycle, there were about 77 hares and 150,000 feeding ticks to the square mile. By comparing the number of feeding ticks in May with the number in the preceding September, it was estimated that 5–20 per cent. of the ticks survive the winter. Most of the gross winter mortality was due to the large percentage of deaths among larvae, which was thought to be 90–98. Weather did not appear to influence markedly either the rate of reproduction of ticks during the summer or the mortality during the winter.

GREEN (R. G.). **Virulence of Tularemia as related to Animal and Arthropod Hosts.**—*Amer. J. Hyg.* **38** no. 3 pp. 282–292, 5 refs. Lancaster, Pa., 1943.

Strains of tularaemia isolated from grouse (*Bonasa umbellus* and *Pedioecetes phasianellus*) in Minnesota produced in guineapigs a definitely less violent infection of longer duration than strains isolated from rabbits (*Sylvilagus floridanus*) or hares (*Lepus americanus*). There was a corresponding difference between infections derived from ticks from these classes of hosts, although in both cases the ticks were principally *Haemaphysalis leporis-palustris*, Pack. As the grouse strains were passed through guineapigs, the length of infection decreased until it was identical with that of the rabbit and hare strains [*cf. R.A.E.*, B **23** 244]. There was no significant difference between the lengths of infections produced by samples consisting of an average of 5 or of 139 ticks from hares or rabbits.

DAVIS (G. E.). **Studies on the Biology of the Argasid Tick, *Ornithodoros nicollei* Mooser.**—*J. Parasit.* **29** no. 6 pp. 393–395, 4 refs. Lancaster, Pa., 1943.

Ornithodoros nicollei, Mooser, which is found in native houses in four Mexican States, occurs in nature on man, dogs and *Neotoma*, and has also been taken on a rattlesnake in zoological gardens in Missouri. It feeds readily on mice and guineapigs. Larvae may engorge and detach themselves in less than 15 minutes or remain attached for several days before completing feeding, but nymphs and adults completed engorgement in 15–23 minutes. Data on the life-history are given from observations made on a stock that was reared from 85 larvae that completed engorgement between 8th and 11th June 1942 and was kept at room temperature in jars containing a saturated solution of ammonium chloride. All larvae moulted in 9–13 days, and nymphs of the first, second, third, fourth, fifth and sixth instars in 8–11, 6–20, 7–14, 11–39, 12–48 and 21 days, respectively. Mortality was considerable only during the larval moult, and 37 males and 27 females reached the adult stage, 31 males and 2 females having passed through four nymphal instars, 6 males and 22 females through five and 3 females through six. Observations on the period between the last engorgement and the beginning of oviposition, made on twelve reared females and nine taken in nature, indicated a tendency to rest in the summer, the period varying from 7 to 233 days according to season. The number of eggs per oviposition, based on 42 counts made on 21 females, varied from 184 to 631. It increased from the first to the third or fourth oviposition. Some females oviposited twice without feeding in the interim. In 23 observations, the period elapsing between the appearance of the first egg and that of the first larva was between 17 and 36

days, and in 70 per cent. of them it was less than 25 days. As many as 98 per cent. of the eggs hatched in batches laid by females that had not paired for a year.

No causal organism of infectious disease has been found in *O. nicollei* in nature, but the rickettsiae of the spotted fevers of the United States, Colombia and Brazil were transmitted with ease in experiments, and those of the Colombian and Brazilian infections were passed through the eggs to the next generation. The causal organism of American Q fever (*Rickettsia diaporica*) and tularaemia bacteria were not transmitted by the bite of the tick, but were conserved in the tissues for 223 and 207 days, respectively, and the bacteria delayed moulting and caused the infected ticks to become dwarfed.

DAVIS (G. E.). **Further Attempts to transmit** *Pasteurella tularensis* **by the Bedbug** (*Cimex lectularius*).—*J. Parasit.* **29** no. 6 pp. 395–396, 5 refs. Lancaster, Pa., 1943.

Examples of *Cimex lectularius*, L., failed to transmit tularaemia to nine guineapigs on which they were allowed to feed over a period of four months following the infective meal by a method that precluded faecal contamination [*cf. R.A.E.*, B **10** 96; **24** 146; **27** 148]. Injection of sample bugs produced a fatal infection after the fourth test feed, but no evidence of infection after the last (ninth). Injection of saline washings of paper on which the bugs had rested, made 36–88 days after the infective feed and 1–16 days after the last meal, caused the death of guineapigs, showing the faeces to be infective. In this way, infection was shown to be present after the seventh test feed. Tularaemia infection seemed to shorten the life of the bug. The progeny of the test bugs, resulting from five successive ovipositions, failed to infect guineapigs at three test feedings and by subsequent injection.

VAIL (E. L.) & AUGUSTSON (G. F.). **A new Ectoparasite (Acarina : Cheyletidae) from domestic Rabbits.**—*J. Parasit.* **29** no. 6 pp. 419–421, 3 figs., 3 refs. Lancaster, Pa., 1943.

A description is given of the female of *Ewingella americana*, gen. et sp. n., all stages of which were found on a domestic rabbit (*Oryctolagus cuniculus*) in California in 1942, in scale, skin scrapings and fur from a patch on the back on which the skin was red, tender and slightly eroded and covered by a slightly oily scale and from which much of the fur had fallen. This Chelytid was definitely parasitic on the rabbit and not predacious on other mites or insects in the fur [*cf. R.A.E.*, B **31** 80].

BURROUGHS (A. L.). **The Flea** *Malaraeus telchinum* **a Vector of** *P. pestis*.—*Proc. Soc. exp. Biol.* **55** no. 1 pp. 10–11, 2 refs. New York, N.Y., 1944.

In the course of a survey to determine the source of plague infection demonstrated in pools of fleas in western California, samples of fleas from 1,356 rodents of four species were identified. The species found on each host are shown in a table. *Ceratophyllus* (*Malaraeus*) *telchinum*, Roths., was the only one common to *Microtus californicus*, *Peromyscus maniculatus* and *Mus* (*Rattus*) *norvegicus*, which are the three rodents known to be naturally infected with plague. It was by far the most numerous on *Microtus californicus*, about twice as abundant as *C.* (*Nosopsyllus*) *fasciatus*, Bosc, on *Mus norvegicus* and only slightly less abundant than *C.* (*Opisodasys*) *nesiotus*, Augustson, on *Peromyscus maniculatus*. Transmission experiments with it were therefore undertaken [*cf. R.A.E.*, B **30** 33; **31** 132]. Ten had been completed when the paper was written, and accounts are given of the four in which positive results were obtained. In each case, fatal infection was transmitted to *Microtus californicus* exposed to the

bites of 25–100 fleas, and in one, a guineapig was also fatally infected by inoculation of a suspension of the triturated bodies of six fleas in salt solution. The sources of infection were *P. maniculatus*, *M. californicus* and a white mouse.

KUBES (V.). **Venezuelan-type Equine Encephalomyelitis Virus in Trinidad.**—*Science* **99** no. 2559 pp. 41–42, 7 refs. Lancaster, Pa., 1944.

The literature on the Venezuelan-type equine encephalomyelitis virus is briefly reviewed. It is the agent of a severe equine encephalomyelitis that has occurred in Colombia since 1935 and in Venezuela since 1936 [and is transmissible by mosquitos (*cf. R.A.E.*, B **32** 56, 57)]. A strain from Venezuela proved to be immunologically identical with a Colombian one and distinct from the eastern and western strains of the United States and from rabies virus. In October 1943, an outbreak of the disease was recorded in the southern part of Trinidad. Virus isolated from brain tissue from a horse and a mule showed the same properties as the Venezuelan strain in white mice, guineapigs and developing chick embryos, and vaccine prepared from the Venezuelan strain conferred on mice an equal protection against the homologous and the Trinidad virus.

RANDALL (R.) & MILLS (J. W.). **Fatal Encephalitis in Man due to the Venezuelan Virus of Equine Encephalomyelitis in Trinidad.**—*Science* **99** no. 2568 pp. 225–226, 6 refs. Lancaster, Pa., 1944.

By October 1943, about 70 horses and mules had died of encephalitis in Trinidad [*cf.* preceding abstract] and one fatal human case had been recorded. A strain of virus isolated from brain tissue of the human case and five strains from donkeys, horses and a mule all caused typical symptoms of equine encephalomyelitis in laboratory animals and fatal infections in guineapigs immunised against the western or eastern strains of equine encephalomyelitis of the United States, but failed to infect guineapigs immunised against Venezuelan equine encephalomyelitis. This is the first proved case of natural infection of man with the Venezuelan virus, though ten non-fatal cases of infection acquired by laboratory workers have been reported.

CRAIG (W.). **The twilight Ceremonies of Horseflies and Birds.**—*Science* **99** no. 2563 pp. 125–126, 4 refs. Lancaster, Pa., 1944.

From a review of the literature, the author concludes that the hovering flights of male Tabanids observed during twilight in the early morning or late evening are not courting flights [*cf. R.A.E.*, B **31** 168], but are, in duration and time of occurrence, fundamentally similar to the twilight song of birds.

LLOYD (Ll.). **Town-planning and the small Sewage Purification Plant.**—*Nature* **151** no. 3834 pp. 475–476, 4 refs. London, 1943.

In the percolating filter system of sewage purification, a more or less constant supply of fine solids and nutritive substances in solution is fed to the filters, and from these is built up a composite growth that tends to choke the passage. The growth is counteracted by scouring organisms, including in particular Enchytraeid worms and larvae of flies. A balanced fauna is most efficient, with some restriction of any one species through the effects of competition [*cf. R.A.E.*, B **28** 150, etc.]. The fact that there must be a large output of flies makes it very undesirable that the filters should be close to dwellings, as they are in a small unit in sewage purification in a congested area.

During the past two years, complaints were made of sewage flies entering dwellings on a housing estate built round a purification plant. The principal pest was *Anisopus fenestralis*, Scop., which was found on bread and was reported

as ovipositing on dish-cloths and green salads. It is not usually one of the commonest sewage flies in England, but was said to have become abundant some eight years before, when an extensive system of sediment tanks was abandoned in favour of a single small patent tank. About this time, a springtail, probably *Hypogastrura* (*Achorutes*) *viatica*, Tullb., which had been common, disappeared and the fly made its appearance. The author concluded that too much solid was being fed to the beds, as each piece of clinker was capped by a heap of slimy débris swarming with Enchytraeids and Nematodes, while, a few inches down in the medium, there was an almost continuous layer of developing larvae of *Anisopus* and *Psychoda*. The final effluent, however, was good, and the situation would not have been unsatisfactory if the plant had not been near houses. As any chemical control would deplete the whole fauna and so lead to choking of the beds and ponding, suggestions were made for testing the effect of certain modifications of the system. It was pointed out, however, that flies must always be numerous about bacteria beds, and the only radical cure would be substitution of an activated sludge system.

Tomlinson (T. G.). **Biological Control of the Fly Population in Sewage Filters.**—*Nature* **152** no. 3845 p. 52, 2 refs. London, 1943.

Observations on the seasonal variation in fly population in large scale percolating filters at Minworth Works, Birmingham, have shown a varied fauna composed mainly of *Psychoda alternata*, Say, *Anisopus fenestralis*, Scop., *Hypogastrura* (*Achorutes*) *viatica*, Tullb., and Enchytraeid worms. Under optimum conditions of growth, *Anisopus* took 121, 73, 50 and 39 days at 9, 13, 18·5 and 21°C. [48·2, 55·4, 65·3 and 69·8°F.], respectively, to complete its life-cycle. With a restricted food-supply, the duration may be much longer. Whereas breeding of *P. alternata* is restricted to the warmer months [*cf. R.A.E.*, B **26** 114, 115], the temperature of the filters is normally favourable throughout the year for the development of *Anisopus*. The filters therefore carry during the winter a large potential population of flies that emerge in spring if conditions are favourable. If the surface layers of the filters are open, *Anisopus* emerges in large numbers during periods of warm weather in the spring, the numbers declining in late spring and early summer when *Psychoda* begins to breed extensively.

At summer temperatures, it appears that *Psychoda* is more effective than *Anisopus* as a scouring organism. Under certain conditions, the accumulation of solid matter in the upper layers of a filter may be sufficient to prevent emergence of *Anisopus* without impairing the efficiency of the filter by causing serious ponding on the surface. Such conditions may prevail in spring in filters operated at high rates as alternating double filters with a short period of alternation, or in a filter treating a mixture of sewage and affluent at a high rate. Extensive emergence of *Anisopus* in the spring is thus prevented. The filters at Minworth became cleared of solid matter by summer owing to scouring activity of *Psychoda*, which emerged in numbers in the summer, while *Anisopus* did not.

This successful competition is a good example of natural biological control and may suggest another line of approach to the problem raised by Lloyd [*cf.* preceding abstract], consistent with the operation of filters at their maximum capacity.

Lewis (E. A.). **East Coast Fever and the African Buffalo, the Eland and the Bushbuck.**—*E. Afr. agric. J.* **9** no. 2 pp. 90–92, 2 figs., 7 refs. Nairobi, 1943.

Evidence in support of and against the theory that *Theileria parva*, the causal organism of African coast fever of cattle, is maintained in and spread

from game animals is briefly reviewed and discussed, and an account is given of an experiment carried out at Kabete, Kenya Colony, in which nymphs of *Rhipicephalus appendiculatus*, Newm., from lots known to be infective, were allowed to feed on two elands, a bushbuck and three African buffalos. The only animal that reacted was one of the buffalos, which contracted the disease in a mild form and recovered. Uninfected ticks fed on it during the febrile period transmitted the disease in a fatal form to cattle, but others fed on it during and after the fall of temperature or on the other animals did not infect cattle. A fourth buffalo was not infected by ticks that had fed on the infected one during its reaction or on an infected ox.

McCarthy (D. D.) & Brent (R. H.). **An Account of an Outbreak of Dengue Fever in Dzaoudzi, Comoro Islands, January, 1943.**—*E. Afr. med. J.* **20** no. 9 pp. 293–298, 2 figs. Nairobi, 1943.

Data are given from which it is concluded that dengue was the cause of an outbreak of fever that occurred in January 1943 in Dzaoudzi, a small island of the Comoro group about 600 yards in diameter. Almost the whole population, both European and African, was involved, and consequently the epidemic died out spontaneously. The numbers of mosquitos had greatly increased in December, following the onset of heavy rain, and remained high throughout January. During a thorough survey of the island, a species of *Eretmapodites* was found breeding in snail-shells and a few adults of a small, dark species of *Aëdes*, possibly *pembaensis*, Theo., were taken, but apart from these, the only biting insect found was *A. aegypti*, L. It was extremely abundant in houses in the second half of January, and immature stages were numerous in domestic breeding places and also in pools round pumps and stand-pipes and the imperfect drains for the disposal of household water. It is pointed out that it should be comparatively easy to eradicate *A. aegypti* completely from the island by making cement water tanks mosquito-proof and removing or oiling all other breeding places. There was evidence that, under the prevailing conditions, the incubation period in the mosquito was 8–10 days. An outbreak of fever is stated to occur every January. It is probable that this also is dengue, and, therefore, that complete immunity is limited to a few months.

Taylor (F. H.). **Sandflies.**—*Aust. Mus. Mag.* **8** no. 6 pp. 210–213, 8 figs. Sydney, 1944.

Notes are given on the breeding habits of Ceratopogonids and species of *Phlebotomus* and *Simulium*, to all of which the name "sandfly" is applied in Australia, and on their relation to disease in other parts of the world. There is no evidence that any of the Australian species transmit disease or even that those of the genus *Phlebotomus* suck blood. Some of the Ceratopogonids are troublesome pests; the genera that occur in Australia include *Culicoides*, *Forcipomyia*, *Dasyhelea* and *Lasiohelea*, and *Styloconops albiventris*, de Meij., attacks man fiercely on the beach at Aitape in New Guinea. Of the Simuliids, *Simulium ornatipes*, Skuse, was, a few years ago, a serious pest of man, cattle and horses in southern Queensland. In the author's experience in Australia and New Guinea, Simuliids always feed at some distance from their breeding places.

Jenkins (C. F. H.). **Ants causing Death in Poultry.**—*J. Dep. Agric. W. Aust.* (2) **20** no. 3 p. 264, 1 fig., 2 refs. Perth, W.A., 1943.

An examination of the crops of fowls that had died suddenly at Dumbleyung in May 1943 showed that they contained a number of winged examples of *Monomorium bicorne*, Forel, including large females. Similar cases of poisoning

have been recorded from two other localities in Western Australia since 1923, and as the distribution of the ant is much wider than this, it is probable that there have been many unrecorded cases in other districts. Although mortality in poultry through eating ants is not common, several species have caused it in different parts of Australia [*cf. R.A.E.*, B **29** 53]. It occurs only during the short period when the females are leaving the nests, as the males and workers are so small that they can contain only a slight amount of formic acid and attract little attention.

Sheep Blowfly Control. Tail Length and the modified Mules Operation for the Prevention of Crutch Strike in Sheep.—*Inform. Circ. Coun. sci. industr. Res. Aust.* no. 12. [In *J. Dep. Agric. S. Aust.* **47** no. 5 pp. 205–207, 5 figs. Adelaide, 1943.]

In this circular, which is a supplement to the second report of the Australian Joint Blowfly Committee [*R.A.E.*, B **29** 1], it is pointed out that the recommendation that the tails of sheep should be left 4 inches long to give maximum protection from strike [*cf.* **31** 29 ; **32** 81] results in tails of very varying lengths when sheep reach maturity, owing to indiscriminate docking at 4 inches on lambs of different ages and sizes. It is therefore advised that the standard adopted should be a tail extending to ½ inch below the tip of the vulva. With regard to Mules' operation, over-emphasis of the importance of the median breech fold is deprecated, and it is stressed that very good results are obtained only when the removal of loose skin results in the stretching and enlarging of the area of bare skin around the vulva. Instructions for carrying out the operation are given. All sheep in a flock should be treated regardless of breech conformation, as treated wrinkly sheep have been found to be less susceptible to strike than naturally plain breeched sheep [**31** 30].

Macfarlane (W. V.). **Blowfly Strike in Marlborough, New Zealand.**—*N.Z.J. Sci. Tech.* **23** no. 4A pp. 205A–213A, 3 figs., 20 refs. Wellington, N.Z., 1942.

Blowfly strike on the sheep of Marlborough Province, New Zealand, was studied in 1938, a season of medium infestation. *Calliphora laemica*, White, was the only species present in over 90 per cent. of the strikes examined. The others were due to *Lucilia sericata*, Mg. Only one case of secondary strike was seen, the species involved being *Chrysomyia rufifacies*, Macq., and *Ophyra analis*, Macq. [*cf. R.A.E.*, B **27** 135]. Breech and back strike and strike of other areas formed, respectively, 67·3, 13·9 and 18·8 per cent. of the total in half-bred, cross-bred and pure-bred English sheep and 26·3, 50·2 and 23·5 per cent. in Merinos. Breech strike was largely confined to young ewes. It was the result of urine-staining, which was associated with vulval deformity in over 80 per cent. of the cases in the half-bred sheep and about 40 per cent. in Merino sheep. The effect of the deflection of the tip of the vulva [*cf.* **27** 197] was not so great as that of irregularity of the labia. Over 33 per cent. of the breech strikes in half-bred sheep were associated with mutilated or ulcerated vulvae. Breech wrinkles were associated with 60·6 per cent. of the breech strikes in Merinos and only 13·1 per cent. on cross-bred or half-bred sheep. Strike from this cause occurred throughout the summer and autumn without relation to rain, but more frequently during periods of hot, humid weather. Faecal contamination was unimportant, except in certain special circumstances. Back strike occurred in Merino sheep during and especially following periods of continuous heavy rain, when the weather was warm and the relative humidity high. The weathered tip wool had different water-soluble constituents from the unexposed staple, as was shown by their lower pH, and it was more attractive to gravid females of *L. sericata*. The inconsistency between this observation and

the suggestion of Davies & Hobson that the humidity of the air at the base of the staple is the main factor in susceptibility [**23** 227] is pointed out. Wetness and high humidity did not cause susceptibility in themselves. Attractiveness probably arises from the action of heavy rain, high humidity and warmth on material accumulated on the tip wool during fine weather. Constant leaching by rain evidently removes the attractive constituents. Back strike was not necessarily associated with fleece rot, but they were often coincident results of the same conditions [**27** 135–136]. Tail strike, which combines the important factors of body and breech strike, was confined to Merino sheep with lateral tail wrinkles.

Cooley (R. A.) & Kohls (G. M.). *Ixodes californicus* **Banks, 1904,** *Ixodes pacificus* **n. sp., and** *Ixodes conepati* **n. sp. (Acarina : Ixodidae).**—*Pan-Pacif. Ent.* **19** no. 4 pp. 139–147, 3 figs. San Francisco, Calif., 1943.

It has been found that the type material from a bird (*Toxostoma crissalis*) from which Banks described *Ixodes californicus* in 1904 consists of nymphs and not of females as he believed. His description and figures are adequate for the recognition of the specimens, which are specifically different from the nymphs of the tick generally accepted as *I. californicus*, and suggest *I. brunneus*, Koch, with which *I. californicus* may eventually prove to be synonymous. In 1908, Banks published descriptions of a male and female that he thought to be *I. californicus* from material from grey fox and black-tailed deer in California. His redescriptions and figures are adequate for the recognition of the common *Ixodes* of the Pacific coast to which the name *californicus* has since been applied and which is here described as *I. pacificus*, sp. n., from adults of both sexes from California and nymphs from British Columbia. Brief notes are given on characters serving to distinguish the nymphs of *I. californicus* and *I. pacificus* and on the adult characters and distributional differences serving to distinguish *I. pacificus* and *I. scapularis*, Say. *I. conepati*, sp. n., is described from two females, one from a cave evidently frequented by various animals and one from *Conepatus* sp., both in Texas.

Parker (R. R.) & Kohls (G. M.). **American Q Fever : the Occurrence of** *Rickettsia diaporica* **in** *Amblyomma americanum* **in eastern Texas.**—*Publ. Hlth Rep.* **58** no. 41 pp. 1510–1511. Washington, D.C., 1943.

The presence of *Rickettsia diaporica* was demonstrated in 1937 in ten out of 92 lots of nymphs and adults of *Amblyomma americanum*, L., collected in eastern Texas in July and August. The infected ticks were collected from goats, cows, dogs and ground vegetation. Passage strains were maintained through several transfers in guineapigs, which showed characteristic manifestations of the infection. Some of those that recovered were tested for immunity from American Q fever and were found to be immune and some were tested for immunity from Rocky Mountain spotted fever and were found to be susceptible. A strain of rickettsia established in eggs was characteristic of *R. diaporica*.

Pratt (H. D.). **The Identification of first stage Larvae of Puerto Rican** *Anopheles*.—*Publ. Hlth Rep.* **58** no. 47 pp. 1715–1717, 1 fig., 4 refs. Washington, D.C., 1943.

A key is given for separating the first-instar larvae of *Anopheles albimanus*, Wied., *A. grabhami*, Theo., and *A. vestitipennis*, D. & K., the species of *Anopheles* occurring in Porto Rico, by means of the spacing and branching of the head hairs, and the characters that have been found reliable for distinguishing first-instar from later-instar Anopheline larvae in Porto Rico are shown in a table.

Collignon (E.). **La campagne antipaludique de 1942 dans le département d'Alger.**—*Arch. Inst. Pasteur Algérie* **21** no. 2 pp. 55–64. Algiers, 1943.

Rainfall was about normal in the department of Algiers in the autumn of 1941 [*cf. R.A.E.*, B **31** 244] and the following winter, but slight in the spring and negligible in the summer of 1942. No spring breeding places of Anophelines appeared, and most permanent ones dried up; malaria was localised and occurred principally among persons who had recently arrived from non-malarious zones. However, the reservoir of infection remained constant. Some breeding places were formed by defective irrigation or the decreased flow of rivers usually flushed by storms. Larvae of *Anopheles maculipennis*, Mg., were found in all types of breeding places from April to November. *A. hispaniola*, Theo., was taken in June in a gravel-bottomed pool that contained filamentous green algae, although the pool had been oiled. The importance of removing protecting algae before oiling to control this species is pointed out.

Wynter-Blyth (M. A.). **A Note on the Transmission of Malaria at Ketti, Nilgiris, 6,300 feet.**—*J. Bombay nat. Hist. Soc.* **44** no. 2 pp. 307–309, 1 ref. Bombay, 1943.

Malaria is not usually transmitted in the Nilgiris at altitudes of more than 4,000 ft. P. F. Russell explained an outbreak that occurred in September 1941 at an altitude of 6,300 ft. in the valley of Ketti [*R.A.E.*, B **31** 117] by the fact that over 2,000 labourers were brought during the year into a place 2–3 miles away, many of them from malarious districts. This might account for the outbreak in question, but not for a few cases that the author records as having occurred in earlier years. He suggests that the easterly and north-easterly winds that prevail, respectively, just before and just after the south-west monsoon, the periods at which the cases of malaria occurred, enter the valley from the malarious plain and reach Ketti as a southerly breeze, encouraging mosquitos normally found at low altitudes to ascend the valley. When these winds are blowing, it is protected, warm, damp and marshy and would therefore favour Anopheline breeding.

Papers noticed by Title only.

Chandler (A. C.). **Additional Records of human intestinal Myiasis caused by *Eristalis*.** [Three cases from Texas.]—*J. Parasit.* **29** no. 6 p. 425. Lancaster, Pa., 1943. [*Cf. R.A.E.*, B **30** 158.]

James (M. T.). **The Genus *Culicoides* in northern Colorado (Diptera, Ceratopogonidae).** [Collection records with descriptions of two new species.]—*Pan-Pacif. Ent.* **19** no. 4 pp. 148–153, 3 figs. San Francisco, Calif., 1943.

Middlekauff (W. W.). **A rapid Method for making permanent Mounts of Mosquito Larvae.**—*Science* **99** no. 2567 p. 206. Lancaster, Pa., 1944.

Thompson (W. R.) Ed. **A Catalogue of the Parasites and Predators of Insect Pests. Section 1. Parasite Host Catalogue. Part 3. Parasites of the Hemiptera.**—$10\frac{3}{4} \times 8\frac{1}{4}$ ins., v+149 pp. multigraph. Belleville, Ont., Imp. Parasite Serv., 1944. Price $(Canad.)2. (Also obtainable from Imp. agric. Bur., 2 Queen Anne's Gate Bldgs., London, price 10*s.*) [*Cf. R.A.E.*, B **32** 67.]

Gordon (R. M.), Unsworth (K.) & Seaton (D. R.). **The Development and Transmission of Scabies as studied in Rodent Infections.**—*Ann. trop. Med. Parasit.* **37** no. 3–4 pp. 174–194, 1 fig., 13 refs. Liverpool, 1943.

As there appeared to be no complete description in the literature of the life-cycle of any burrowing mite causing scabies in man or animals and no reliable account of the stages responsible for its transmission from one host to another, the development of *Notoëdres* sp. was studied on white rats. It is thought improbable that any essential difference will be found between the life-cycles of *Notoëdres* and *Sarcoptes*. The methods are described. The burrows of *Notoëdres* occur principally on the ears, snout, tail and anogenital region of the host, and on the lower part of the limbs where the hair is fine and scanty. Occasionally the mites penetrate below the horny layer of the skin, and serum forms a coagulum marking the site of penetration [*cf. R.A.E.*, B **30** 145]. It is concluded from the observations that some 50 eggs are laid by each female in the breeding tunnels in the horny layer. Larvae hatch in 4–5 days, and some develop in the parent tunnels or in side-pockets off them, at least as far as the nymphal stages, but most reach the surface of the skin, where those that do not perish or get transferred to new hosts burrow into the horny layer and excavate small pockets or moulting tunnels. They feed in these until after the first moult, which occurs on about the tenth day after oviposition. It is thought that larvae cannot wander on the surface of the skin for more than 48 hours. Only one larval pocket of *S. scabiei*, Deg., was found in natural infestations of man, and it was similar to those produced by *Notoëdres*. The belief that the larvae of *S. scabiei* enter hair follicles [*cf.* **31** 86] is questioned; larvae of *Notoëdres* were never observed to do so. The manner in which the burrows are excavated is described. Larvae penetrated in 25–270 minutes. Ecdysis begins 4–6 days after the excavation of the pocket and is completed in two days. Most of the first-instar nymphs leave the pockets to make fresh ones, but some remain in them. The next moult occurs about 13 days after oviposition, and the nymphs of the second instar, like those of the first, either remain in the moulting pockets or leave them to make others. The final moult to the adult stage occurs about 16 days after oviposition or 12 days after hatching. The males leave the moulting tunnels and wander in search of the females, feeding from time to time in small burrows that they make in the skin. It is presumed that the females remain in the moulting tunnels until fertilised by the males, which sometimes reach them by tunnelling through the wall of the pocket. The fertilised females extend the moulting tunnels to form the typical, tortuous breeding tunnels, in which the eggs are laid at the rate of 3–4 a day beginning 4–5 days after pairing. Female life probably does not exceed 3–4 weeks. It is believed that, unless disturbed, the adult ovigerous female never leaves the breeding tunnel and that, unlike that of *S. scabiei*, it cannot excavate a fresh burrow if removed and placed on the surface of the skin. This life-history corresponds in its main outline with that given for *S. scabiei* by F. Hebra in 1868, which is summarised. The authors also quote from a brief life-history by Johnson in a paper already noticed [**31** 172] many items of which they consider to be unproved and improbable.

Experiments, which are described, showed that the free-living population of *Notoëdres* consists of larvae, nymphs, males and, very rarely, females, which formed 90, 3, 7 and 0 per cent. of it, respectively, in one observation, while the respective percentages of these forms in the subsurface population were 37, 20, 3 and 40. At the time of the observation, 15 per cent. of the total population was free-living. In another series of observations, the approximate percentages of larvae, nymphs, males and females among mites on the surface were 85, 7·5, 6·4 and 0·3, respectively. It is apparent from these data that the females take no significant part in the spread of infestation on the host or in its transmission from one host to another. It is concluded that infestation spreads locally from the primary lesion as a result of the distribution of larvae and

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nymphs, mainly through the agency of the host by scratching but partly through their own activity. It was proved in a series of experiments that the larvae and nymphs of *Notoëdres* forming the free population are readily transferable from one host to another, either by direct contact or indirectly through inanimate objects, and that nymphs or as few as five larvae thus transferred can establish themselves and produce scabies. Scabies developed in only one out of five rats following the transfer to them of adult non-ovigerous females. It is suggested that infestation by *Sarcoptes*, as well as by *Notoëdres*, is transmitted by the immature stages and not, as other workers have supposed, by the females.

GORDON (R. M.) & UNSWORTH (K.). **The lethal Action of Benzyl Benzoate, Dimethylthianthrene (Mitigal) and Tetraethylthiuram Monosulphide (Tetmos) on the Scabies-producing Mites, *Notoëdres* sp. and *Sarcoptes scabiei* var. *hominis*, when tested *in vitro*.**—*Ann. trop. Med. Parasit.* **37** no. 3–4 pp. 195–199, 1 graph, 5 refs. Liverpool, 1943.

Benzyl benzoate, dimethylthianthrene (dimethyl-diphenylene disulphide) and tetraethylthiuram monosulphide, which are effective against scabies in practice [*R.A.E.*, B **30** 118, 145, 180; **31** 86, 146], proved lethal to mites of the genus *Notoëdres* that were immersed in solutions diluted to a concentration of 5 per cent. (weight in volume) with oil. Larvae were slightly more resistant than nymphs or adults. The percentages (with a constant proportion of stages) surviving ten hours' immersion were 5·9 for tetraethylthiuram monosulphide, 58·8 for dimethylthianthrene and 89·6 for benzyl benzoate. Nine out of ten ovigerous females of *Sarcoptes scabiei*, Deg., survived immersion for 23 hours in the benzyl-benzoate solution, whereas only three out of nine survived for the same period in the solution of tetraethylthiuram monosulphide. No difference in the toxicity of the solutions was observed when sesame oil was used instead of olive oil as the diluent.

GORDON (R. M.), DAVEY (T. H.), UNSWORTH (K.), HELLIER (F. F.), PARRY (S. C.) & ALEXANDER (J. R. B.). **Control of Scabies by Use of Soap impregnated with Tetraethylthiuram Monosulphide (Tetmosol).**—*Brit. med. J.* no. 4354 pp. 803–806, 6 refs. London, 1944.

The following is substantially the authors' summary. Tetraethylthiuram monosulphide (tetmosol) was shown to retain its sarcopticidal properties when combined with soap in 5, 10, and 20 per cent. dilutions. In cases of rat scabies due to *Notoëdres*, daily or weekly use of this soap eliminated the local infestation in some cases and reduced the mite population in others. Six men were completely freed from *Sarcoptes scabiei*, Deg., after five or six baths with 20 per cent. tetmosol soap on successive days. A further series of 110 men received three baths with 20 per cent. tetmosol soap over a period of a week. All remained under observation for at least six weeks, at the end of which period 88 (80 per cent.) were found to have been cured of scabies, and 22 to have relapsed.

Although tetmosol soap is unlikely to supersede any of the standard treatments for scabies, which result in more than 90 per cent. cures, the simplicity of procedure suggests its possible value for therapeutic use in communities in which disorganisation as a result of war makes it impracticable to employ the standard methods.

The protective value of the soap was tested by washing the tails of clean rats heavily exposed to *Notoëdres* from their companions. Washing once weekly with 5 and 10 per cent. tetmosol soap was followed by a marked reduction in the number of mites developing in the skin as compared with controls washed with unmedicated soap. When 20 per cent. soap was similarly used, two rats were

completely protected over 22 days, and the third developed only a very light infestation. In contrast to the partial protection by weekly washing, the regular use of 5 per cent. tetmosol soap twice daily gave complete protection to the treated area during periods of 25–36 days (the duration of the experiment). Little or no protective action followed the use of unmedicated soap.

These results indicate that the generalised use of tetmosol soap in a community would reduce the incidence of scabies by sterilising some existing cases and by destroying the mites on freshly invaded persons. Such generalised use, however, will only be possible if it is found that a high incidence of dermatitis does not follow prolonged use of the soap. The authors found that the incidence of dermatitis following its use for short periods was low, and that it was low also among a small number of people tested over a prolonged period, but no estimate can be made of the risk without more extensive trials.

PASFIELD (G.) & WOODHILL (A. R.). **Ground Derris Root as a Mosquito Larvicide.**—*Proc. Linn. Soc. N.S.W.* **67** pt. 5–6 pp. 343–348, 12 refs. Sydney, 1942. [Recd. 1944.]

Previous experiments with derris as a mosquito larvicide are reviewed [*R.A.E.*, B **12** 162; **15** 17, 232; **17** 139, 245; **27** 232], and an account is given of tests to determine whether it could be used under certain conditions to control the larvae of Australian mosquitos. They were made with aqueous suspensions of a derris powder yielding 19·8 per cent. total extractives and 3·8 per cent. rotenone, and with filtrates of the suspensions. Laboratory tests were made with dishes each containing 25 larvae in 250 cc. of the liquid with or without the addition of fish food and yeast (0·04 gm. per dish). Temperature was maintained at 80° F. and relative humidity at 70–80 per cent.

The minimum concentration of the suspension that caused complete mortality of early third-instar larvae of *Culex fatigans*, Wied., within 48 hours was 0·01 gm. per 1,000 cc. when the larvae were supplied with food, but when no food was available, the minimum concentration and time required to give complete kill were both lowered [*cf.* **28** 242]. The suspension was toxic to larvae of *C. fatigans* of all instars, but the concentration required to give complete kill rose with each succeeding instar. The liquid obtained by filtering a suspension of 0·01 gm. in 1,000 cc. water, after mixing for 24 hours, gave 91 per cent. kill of third-instar larvae in 48 hours, the filtrate from a suspension of twice this strength gave complete kill in 20 hours, and a suspension at the latter concentration gave complete mortality in 48 hours after standing for eight days exposed to light but not directly to the sun. In these tests, the larvae were supplied with food. Ground derris root was as toxic to larvae of *Aëdes concolor*, Taylor, in sea-water as to larvae of *C. fatigans* in fresh water. In a field test in warm, sunny weather, all the larvae of *A. concolor* in a sea-water pool and most of the pupae were killed in 48 hours by 0·04 gm. ground derris root per 1,000 cc. It is recommended that a concentration of not less than 0·02 gm. powder per 1,000 cc. should be used in practice, and that derris should not be used on drinking-water tanks. It could be used in sewage works as it has little or no harmful effect on bacteria.

TAYLOR (F. H.). **Contributions to a Knowledge of Australian Culicidae. No. VI.** —*Proc. Linn. Soc. N.S.W.* **68** pt. 3–4 pp. 153–157, 6 figs. Sydney, 1943.

This part of a series [*cf. R.A.E.*, B **31** 121] comprises descriptions of the females of *Anopheles* (*Myzomyia*) *derricki*, sp. n., *A.* (*M.*) *perplexus*, sp. n., *A. perplexus* var. *persimilis*, n., and *A.* (*M.*) *breinli*, sp. n., all from Queensland, and figures of the male characters of the first two. *A. perplexus*, which was also found in the Northern Territory, enters houses freely for feeding and remains there until the late forenoon. It is thought probable that var. *persimilis* will prove to be a distinct species when males are available.

Williams (F. X.). **Mosquitoes and some other noxious Flies that occur in New Caledonia.**—*Hawaii. Plant. Rec.* **47** no. 4 pp. 205–222, 15 figs., 42 refs. Honolulu, 1943.

In 1940, the author spent four months in New Caledonia investigating the harmful insects there in view of the possibility of their being accidentally introduced into Hawaii. He found nine species of mosquitos including one, *Culex pseudomelanoconia*, Theo., that had not previously been taken in New Caledonia. This brings the total number of species recorded for the island to eleven. A list of them is given, with their synonymy, and usually including notes, sometimes from the literature, on morphology, distribution, habits, and place and date of capture. No evidence was found of the presence of *Anopheles punctulatus*, Dön. [*cf. R.A.E.*, B **30** 186]. Other noxious Diptera taken were *Hippobosca equina*, L., on horses, an unidentified species of *Simulium*, Tabanids, *Musca domestica vicina*, Macq., and *Stomoxys calcitrans*, L.

Knowles (R.) & Basu (B. C.). **Laboratory Studies on the Infectivity of *Anopheles stephensi*.**—*J. Malar. Inst. India* **5** no. 1 pp. 1–29, 2 figs., 14 refs. Calcutta, 1943.

Basu (B. C.). **Laboratory Studies on the Infectivity of *Anopheles annularis*.**—*T.c.* pp. 31–51, 2 refs.

The results of an extensive series of experiments on the effect of atmospheric temperature and relative humidity on the ability of *Anopheles stephensi*, List., to transmit malaria in India are given in the first paper. The mosquitos were kept in an air-conditioning cabinet, the construction of which is described, that enabled temperature to be controlled at any level between 50 and 100°F. and relative humidity between 50 and 100 per cent. The females used were bred from larvae collected in the field and reared in unfiltered water. At a continuous temperature of 37°C. [98·6°F.], the larvae developed rapidly, but died before pupating. The temperature of the water in the roof tanks in Calcutta sometimes reaches or passes this point, but it falls to 27°C. [80·6°F.] or lower in the early morning, so that development is not prevented. The females did not feed until 8–24 hours after emergence, and most of them did not bite freely until about 32 hours had elapsed. They were allowed to engorge on persons with gametocytes of *Plasmodium vivax*, *P. malariae* and *P. falciparum* in their blood, and dissected after being kept for various periods under controlled conditions. Only mosquitos that survived until dissection were considered in determining the rates of infection, but the rates of survival of the mosquitos were also determined.

Temperature appeared to be a more important factor in the transmission of malaria by *A. stephensi* than humidity. The females lived longest at low temperatures and high relative humidity. High humidity was not essential for long life between 50 and 80°F. if sufficient food (fruit juice) and water were provided, but it was most important at higher temperatures. In experiments in Calcutta in 1933 with temperature and humidity uncontrolled, spring and hot weather conditions were the most unsuitable for both gut and gland infection in *A. stephensi* [*cf. R.A.E.*, B **21** 78]. Rates of experimental infection were high under controlled conditions simulating those of the monsoon, post-monsoon, and cold weather periods. Gland rates were highest under monsoon conditions and gut rates under post-monsoon and cold-weather conditions. Gut and gland infections with *P. vivax*, *P. malariae* and *P. falciparum* under conditions representing the five different seasons in Calcutta are summarised. In a study of the effect of temperature, no infection was obtained with any species of *Plasmodium* at 50°F., and no female lived long enough to become infective at 100°F. Gut rates were highest (42 per cent.) at 70°F., but fairly high at 80 and 90°F., and gland rates were highest (34 per cent.) at 80°F. and about 10 per cent. at 70 and 90°F. The results of experiments on the effect of relative humidity

were often contradictory, and no definite conclusions could be drawn from them. Both gut and gland infections with *P. vivax* occurred at temperatures between 60 and 90°F., the optimum apparently being between 70 and 90°F., and at relative humidities between 50 and 100 per cent., with no evident optimum. The complete development of *P. vivax* up to the sporozoite stage took 18, 15, 11 and 9 days at 60, 70, 80 and 90°F. No gland infection was obtained with *P. malariae*. Gut rates were highest at 70°F., but considerable at 80 and 90°F., and highest at 70 per cent. relative humidity, though some infection occurred throughout the range. Infection with *P. falciparum* occurred between 70 and 90°F. and between 50 and 100 per cent. relative humidity. Gut rates were highest at 70°F. and 90 and 100 per cent. relative humidity and gland rates were highest at 80°F. and approximately equal over most of the humidity range. The complete development took 14, 10 and 9 days at 70, 80 and 90°F. Copious data are given on the rates of infection of *A. stephensi* with each of the three species of *Plasmodium* at 36 combinations of temperature and relative humidity. The maturity and numerical density of gametocytes in the donor's blood considerably influenced the infection in the mosquitos, but they did become infected with each species of *Plasmodium* when there were fewer than 40 gametocytes per cu. mm.

The second paper deals with similar studies carried out with *A. annularis*, Wulp., between 1936 and 1939. Over 12,850 laboratory-bred females were fed on 129 gametocyte-carriers and exposed to 34 different combinations of temperature and relative humidity. Of the total, 41 per cent. survived until dissection, and 17 and 5 per cent. of the survivors showed gut and gland infection, respectively. Atmospheric temperature had a great influence on the life of the mosquitos, which was prolonged at lower temperatures, and on the development of *Plasmodium*, but relative humidity apparently had no direct influence on the development of *Plasmodium* in the mosquitos, though their life was prolonged by high humidity at higher temperatures. No mosquito survived long enough at 100°F. for infection to develop. Both gut and gland rates were greatest (41 and 16 per cent.) at 90°F. Gut and gland infections with *P. vivax* and *P. falciparum* were observed at 60–90°F. Gut rates for the two species were highest at 80 and 90°F., respectively, and gland rates at 70 and 90°. The only infections observed at 50°F. were a few gut infections with *P. falciparum*. Gut rates with *P. malariae* were moderately high at 80 and 90°F., but no gland infections with this species were seen. The number of observations made with it was very limited. Data are given on gut, gland and total infections with each species of *Plasmodium* at various combinations of temperature and relative humidity. The density and maturity of gametocytes in the donor's blood had an important bearing on the infection in mosquitos.

ADISUBRAMANIAM (T. S.) & VEDAMANIKKAM (J. C.). **The Relationship between the Breeding Places of *A. fluviatilis* and human Dwellings and its Significance in limiting the Scope of antilarval Measures.**—*J. Malar. Inst. India* **5** no. 1 pp. 53–58, 2 maps, 1 ref. Calcutta, 1943.

The inhabitants of the Wynaad do not live in compact villages, but in small groups of huts scattered along the hill slopes and margins of the valleys, and *Anopheles fluviatilis*, James, feeds in the huts and breeds mainly in the streams and irrigation channels in the valleys [*cf.* *R.A.E.*, B **28** 162].

Between October 1941 and March 1942, larvae of this Anopheline were collected weekly from every 100-ft. section of the channels running in two selected areas, and in both they were found to be most abundant within 1,000 ft. of dwellings [*cf.* *loc. cit.*]. One of the areas had only one main channel. The 1,000-ft. stretch of this channel where the larvae had been most numerous was oiled from 18th March to 23rd June 1942 and the abundance of *A. fluviatilis* in the huts at that time was compared with that in 1941. The numbers per

collection were 8·0, 10·7, 2·3 and 4·7 in March, April, May and June 1941, respectively, and 7·5, 1·5, 2·6 and 2·4 in the corresponding months in 1942. It is the recognised policy in India to limit mosquito control to the area within half a mile of the site to be protected. This investigation indicates that measures against larvae of *A. fluviatilis* may be limited to breeding places situated within 1,000–1,500 ft. of dwellings.

Russell (P. F.), Knipe (F. W.) & Sitapathy (N. R.). **Malaria Control by Spray-killing Adult Mosquitoes : fourth Season's Results.**—*J. Malar. Inst. India* **5** no. 1 pp. 59–76, 1 pl., 6 refs. Calcutta, 1943.

The results obtained in 1941, the fourth and last season of experiments on the control of malaria in villages in southern India by spraying houses, animal sheds and outbuildings with pyrethrum to kill Anophelines [*Anopheles culicifacies*, Giles] in their day-time resting places, are given in this paper [*cf. R.A.E.*, B **28** 92 ; **29** 153 ; **30** 168]. They fully confirm those of the previous years. Notes are included on the various types of equipment used, which comprised improved hand atomisers, knapsack-type, high-pressure tanks in which the pressure was generated by hand-pumping or by power, and power-operated pressure outfits operated by one or two men [**31** 76]. A modification of the De Vilbiss G. S. paint sprayer [**28** 93] with attached pressure regulator set at 15 lb. per sq. inch is referred to as the standard spraying equipment and was used with most sprayers except the hand atomisers. Solidified carbon dioxide was not used, but it is considered the best medium for distributing insecticides [**30** 83-84]. Directions are given for extracting Nilgiris pyrethrum with kerosene to make a kerosene-base spray [**30** 169] and water emulsions. For the latter purpose only 5, 5 and 2 gals. kerosene were used for the three extractions per 20 lb. flowers as compared with 10, 5 and 5 gals. when the extract was to be used in kerosene. The emulsions were prepared with 1 gal. extract, either 4 or 7 gals. water and 23 gm. emulsifier (sodium lauryl sulphate) per gallon of the final mixture. Water emulsions were not so stable as sprays diluted with kerosene, but this is not a serious fault where it is possible to prepare a fresh supply each day. Both types were nearly as effective as Pyrocide 20 in kerosene (1 : 19) [*cf.* **30** 169], and very much cheaper, particularly the water emulsions. The operations, each directed to provide information on a different aspect, were carried out in seven villages of various sizes. Accounts are given of the measures taken in each and of the spleen and parasite rates in this and preceding seasons. Results were excellent, malaria transmission being greatly reduced, though a considerable rise in the spleen and parasite rates in the village in which the experiments were begun, which had been sprayed in 1938, 1939 and 1940 and was not sprayed in 1941, showed that the effect is not permanent and spraying must be carried out every year. Decline in spleen and parasite rates was not so satisfactory in a village in which spraying was carried out every 9–10 days as in villages sprayed weekly. Treatment with plasmochin did not significantly increase the effect of spraying in villages included in the experiments for the first time. In two villages sprayed in 1940, the amounts of spray used per 1,000 cu. ft. were 0·74 and 1·24 oz. and the amounts used in the same villages in 1941 fell between these limits. It is believed that as a result of the improvements effected in technique and materials, spraying is now an economically practicable method of controlling malaria in rural areas in southern India.

Rajindar Pal. **On the Bionomics of *Anopheles culicifacies* Giles. Part I. Longevity under controlled Conditions of Temperature and Humidity.**—*J. Malar. Inst. India* **5** no. 1 pp. 77–85, 3 figs., 23 refs. Calcutta, 1943.

The following is mainly based on the author's summary of the results of observations on the effect of temperature and humidity on the length of life of

females of *Anopheles culicifacies*, Giles, most of which were bred from eggs laid by gravid females collected in nature in the Punjab and given a blood meal 10 hours after emergence. Females exposed to a constant temperature of 104°F. did not survive for more than 19 hours, irrespective of changes in relative humidity ranging from 20 to 100 per cent. They lived for 4–10 days at 95°F., with the same range of relative humidity. Very low and very high relative humidities at this temperature shortened life. The females survived for 6–18 days at 86°F. and 14–28 days at 77°F. At all these temperatures, the differences in the period of survival appeared to depend on the humidity, and the periods were longest when it was 60–80 per cent. The period of survival at 65°F. and 80 per cent. relative humidity was 33 days ; at 55°F., it was 4–8 weeks, and increased progressively as the relative humidity rose. The females died if exposed for 5 minutes to 28·4 or 122°F. or for 1 hour to more than 105·8°F. Field investigations made at Lahore confirmed these observations. A temperature of 77–86°F. and a relative humidity of 60–80 per cent. appeared to provide optimum conditions, and this combination is also suitable for the development and transmission of malaria parasites.

The prolonged survival at 55°F., the finding of both larvae and a few adults (including males) in winter, and an experiment in which larvae that hatched in November completed their development in 80–105 days at water temperatures of 9·5–13°C. [49·1–55·4°F.] together show that both larvae and adults overwinter in the Punjab [*R.A.E.*, B **19** 244 ; **24** 259].

COVELL (G.) & JASWANT SINGH. **Antimalaria Operations in Delhi. Part IV.**—*J. Malar. Inst. India* **5** no. 1 pp. 87–106, 8 figs., 10 refs. Calcutta, 1943.

Malaria in northern India is characterised by the occurrence of periodical, regional epidemics of varying severity and extent at intervals of several years. Until such an epidemic had been experienced, it was not possible to assess the adequacy of the organisation set up for Anopheline control in Delhi in 1936 [*R.A.E.*, B **27** 207 ; **28** 161 ; **30** 101], although incidence had become negligible during the inter-epidemic period. A severe regional epidemic, involving large areas of the Punjab, United Provinces and Delhi Province, occurred in the autumn of 1942. An account of its effect in the Delhi urban area is given. One contributory cause of the epidemic was abnormally heavy monsoon rainfall in July, followed by a high river level persisting for an unprecedented period and leading to extensive flooding through the percolation of sub-soil water above ground level. This provided ideal breeding places for *Anopheles culicifacies*, Giles, the only vector of any importance in the region, which increased greatly in density as compared with previous years. Another cause was high atmospheric humidity, which promotes activity and longevity in the mosquito. Moreover, communal immunity of the population was very low as nine years had elapsed since the previous epidemic, and there were various additional local factors. However, the number of cases treated at the municipal dispensaries between July and November inclusive was 26 per cent. less than in 1933, the last epidemic year, although the population had increased by 50 per cent. Data are given on spleen rates in various parts of Delhi from 1936 to 1942. In 13 out of the 15 wards in the urban area in which school children were examined, the rates recorded in November 1942 were lower than the corresponding rates for 1936. In the riverain area, which was most seriously affected, the rates were higher than those for 1936 in about half of the places examined. Detailed results are also given of spleen and blood examinations in selected communities. Out of 2,086 positive films from various parts of Delhi examined between July 1942 and February 1943, 1,379 contained *P. falciparum*, 799 contained *P. vivax* and only one contained *P. malariae*. In the late summer and autumn, only 0·5 per cent. infection was found among 9,628 females of *A. culicifacies* dissected. However, the proportion shown by the precipitin test to have fed on human blood was

22·3 per cent., as compared with only 1·6 per cent. in the inter-epidemic period [*cf.* **28** 92]. This is thought to indicate that *A. culicifacies* feeds indifferently on man and cattle and that the conditions prevailing in 1942 caused it to enter urban areas more than usual and consequently increased its opportunities for feeding on man. The low infectivity rate is attributed to the intensive campaign of spraying with pyrethrum extract in oil or oil emulsion to kill mosquitos in dwellings, which was carried out systematically throughout the malaria season over a belt 400–800 yards wide extending along the eastern and southern borders of the urban area. This was the chief emergency measure. The emulsions yielded excellent results when applied with petrol-driven power sprayers, which were much more effective than hand-operated ones. With the latter, an oil-base spray was preferable. It is considered that the intensity of the epidemic was greatly reduced as the result of the elimination of potential breeding places for Anophelines by the permanent engineering works carried out during the previous five years [**30** 101], supplemented by the emergency measures. Had sufficient power sprayers been available for daily spraying, it is believed that the epidemic could have been kept under complete control.

Sundaresan (B.) & Appa Rao (M.). **The Distribution of *Anopheles sundaicus* in Vizagapatam District ; with Notes on certain Points of Differentiation between the Larvae of *A. sundaicus* and *A. subpictus*.**—*J. Malar. Inst. India* **5** no. 1 pp. 107–112, 1 map, 2 refs. Calcutta, 1943.

Records are given of the collection of *Anopheles sundaicus*, Rdnw., between October 1938 and March 1943, along the coast in the north-east of Vizagapatam District, Madras, where its range extended to a hamlet 70 miles south of the Orissa border. Cases of fever were occurring there at the time, and a severe epidemic of malaria was experienced in the neighbourhood in 1937. It is stated in a foot-note that *A. sundaicus* was later taken at a place 10 miles further south where the spleen rate was 44 per cent. The immature stages are usually found only on the foreshore and a strip of coast about half a mile wide, generally in lagoons, reservoirs, ponds and borrowpits, where sheets of algae are present, and rarely in disused masonry wells, fallow rice-fields, casuarina pits and spring pools. When conditions are suitable, they may also occur in channels and tidal rivulets, and in depressions a mile or more inland that have been flooded by the tide. The adults showed a marked preference for human dwellings as day-time resting places, and were taken chiefly on the walls and ceilings of attics, lofts or dark rooms in which there was not much disturbance. The houses of the area are made of mud, wood and thatch.

Several hundred larvae of *A. subpictus*, Grassi, from fresh and salt water and of *A. sundaicus* were examined, and the differential characters recognised by Venhuis [*R.A.E.*, B **27** 64] tabulated ; the larvae were then reared to the adult stage for identification. Gravid females of *A. sundaicus* were also collected, and the larvae reared from the eggs deposited by them were examined for the distinguishing characters. From an analysis of the figures obtained, the percentages of larvae of the three groups showing some of the main differentiating characters are tabulated, and the significance of the characters is discussed.

Subbaraman (A. K.) & Vedamanikkam (J. C.). **Trimming the Edges of Breeding Places near human Habitations as an antilarval Measure.**—*J. Malar. Inst. India* **5** no. 1 pp. 113–115, 1 fig. Calcutta, 1943.

The value of trimming the edges of perennial streams to control *Anopheles fluviatilis*, James, in southern India was tested in 1941 on a section of stream 100 ft. long and 20 ft. wide. The right bank of half the section and the left bank of the other half were trimmed and the opposite banks left untreated as controls. From 28th February (just after trimming) to 29th April, 64 larvae of

A. fluviatilis and 47 of other species were caught along the untrimmed edges while none of *A. fluviatilis* and only two of other species were taken along the trimmed banks. The method consists of cutting the banks vertically with a spade and removing vegetation and loose stones projecting above the surface to expose the water at the edges to sunlight and to increase its rate of flow. It was applied during February 1942 as the only control measure along about a mile of perennial stream in the Wynaad, in which the density of breeding of *A. fluviatilis* (the number of larvae taken in an hour) was 17. Both edges were treated, and no larvae were found in collections made for a month after trimming. The cost of the initial work and maintenance is discussed. It compared very favourably with that of all other control measures practised in the area. In the Wynaad, the initial work should be completed before 15th December and maintenance continued until the monsoon begins in early June.

Roy (D. N.). **The Rôle of *Anopheles subpictus* Grassi as a Carrier of Malaria.**—*J. Malar. Inst. India* **5** no. 1 pp. 117–121, 19 refs. Calcutta, 1943.

The work described was carried out to elucidate the part played by *Anopheles subpictus*, Grassi, in the transmission of malaria in India and particularly in the salt-lake areas near Calcutta. A salt-water form [*cf. R.A.E.*, B **17** 84] from these areas was used in all experiments. Of females collected in the morning in October–December from cow-sheds separated from dwelling rooms by thatched partitions through most of which they could pass freely, over 1,500 gave positive results in precipitin tests and 25 per cent. contained human blood. The highest percentage previously recorded for this species in India was 3·1. The oöcyst and sporozoite rates obtained in experimental infections were 29 and 7 per cent., respectively, as compared with about 50 and 40 per cent. in females of *A. stephensi*, List., fed at the same time on the same gametocyte carrier. In laboratory studies on the length of life of females of *A. subpictus* caught on the morning after they had fed, an average of 16·2 per cent. survived for 10 days during January and February and 2·7 per cent. for 15 days [*cf.* **23** 18]. It is concluded from these findings, considered in conjunction with the literature [**24** 127; **27** 208], that *A. subpictus* can probably play some part in the transmission of malaria, particularly in the more humid parts of India, but that its practical importance is negligible.

Bana (F. D.). **A Note on the Adaptability of *Anopheles stephensi* to breed in Salt Water in Bombay; with some Observations on larvivorous Fish.** (Abstract.)—*J. Malar. Inst. India* **5** no. 1 p. 123. Calcutta, 1943.

Anopheles stephensi, List., the vector of malaria in Bombay, breeds in the salt pans in September and October when they are used for rearing fish. By introducing *Gambusia* successively into graduated mixtures of fresh and sea water it was found that these fish could survive for 24–48 hours in a mixture of equal parts, which had a specific gravity of 1·015. This is about the salinity of the salt pans in September and October when they are diluted by monsoon rains. A marked reduction in the density of *A. stephensi* in the neighbourhood resulted from the stocking of the salt pans with *Gambusia*. *Horaichthys setnai*, a fish that thrives both in salt and fresh water, also consumed mosquito larvae, but only those three days old or less. *A. stephensi* was found to breed also in sea water stored for fire-fighting, when it had become diluted with rain water, and even occasionally when the specific gravity was equal to that of sea water (1·030).

Jaswant Singh & Jacob (V. P.). **Malaria in Ahmedabad.** (Abstract.)—*J. Malar. Inst. India* **5** no. 1 p. 127. Calcutta, 1943.

A malaria survey was made between 12th May and 11th November 1941 in Ahmedabad (Bombay), where the malaria season extends from July to November

with the peak in September or October. Spleen rates were below 10 per cent. throughout the urban area, but considerably greater in four localities, the highest being 42 per cent. The higher rates were found in mill areas where Anopheline breeding places were most numerous. The only species of *Anopheles* found infected were *A. stephensi*, List., which had an infectivity rate of 1·4 per cent. and *A. culicifacies*, Giles, in which only one infection (gland) was found in 234 specimens dissected. *Plasmodium vivax* and *P. falciparum* were present in about equal numbers in the blood films examined, but only one infection with *P. malariae* was seen.

Ellis (J. M.). **Notes on the Collection and Oviposition of** *Anopheles walkeri*.—*J. Tenn. Acad. Sci.* **19** no. 1 pp. 29–30, 3 refs. Nashville, Tenn., 1944.

Additional information on *Anopheles walkeri*, Theo., at Reelfoot Lake Tennessee [*cf. R.A.E.*, B **32** 33] was obtained from the north-east side of the lake between 15th June and 31st July 1942. The larvae occur in the shallow saw-grass border along the eastern shore, and the adults rest on the stems of emergent water plants by day and fly inland at night. They entered a basement as soon as the lights were turned on, but were far less numerous there than *A. quadrimaculatus*, Say. Adults of both species were caught in approximately equal numbers in New Jersey light-traps, the peak of collection being from 16th to 20th July, when 25–50 examples of *A. walkeri* were taken nightly. All the females of this mosquito caught were separated into fed and non-fed groups and the latter kept in small lantern globes covered with wet cellucotton until fed on the collector. Each fed mosquito was put in a 2-oz. screw-cap glass bottle with saturated filter paper on the bottom. As a rule eggs were laid on the third or fourth day, but many of the mosquitos died without ovipositing. After oviposition, only a few remained active enough to feed again, and none laid further eggs. Attempts to induce females confined in large tubes to oviposit in small dishes containing wet filter paper were less successful. Filter papers were removed daily from bottles containing eggs, folded with the eggs in the centre and put in small glass vials, which were then corked, packed in cotton and crushed ice, and sent to the Malaria Research Laboratory at Colombia, South Carolina. In the laboratory the eggs were washed into enamel pans, in which most of them hatched, and the larvae were reared. Of 329 females taken, 76 per cent. took or had taken blood meals and 24 per cent. died without feeding. Of those that fed, 58 per cent. oviposited. The egg-batches contained 100–200 eggs, the average being over 150.

Gurney (A. B.). **A Mosquito Survey of Camp Crowder, Missouri, during 1942.**—*J. econ. Ent.* **36** no. 6 pp. 927–935. Menasha, Wis., 1943.

An account is given of the methods used and results obtained in a mosquito survey of a military camp in south-western Missouri made from April 1942 until the end of the year. The rainfall was much above normal. Of the 31 species found in and near the reservation, 26 were taken as larvae, 22 in light-traps and 23 in hand collections. The most prevalent were *Anopheles punctipennis*, Say, *Culex pipiens*, L., *C. restuans*, Theo., *Aëdes vexans*, Mg., and *Psorophora confinnis*, Lynch (*columbiae*, D. & K.). *Anopheles quadrimaculatus*, Say, is generally distributed over the area, but was taken in only small numbers; favourable breeding places in or near the reservation are few, as much of the water appears to be too cold. There were no known cases of malaria transmission. The other Anophelines recorded were *A. crucians*, Wied., and *A. barberi*, Coq. *Aëdes aegypti*, L., was not found. Pest species originating in puddles, temporary pools and ditches are among the most important problems, but control measures were carried out as necessary in 1942, and mosquitos were never more than a minor nuisance.

McGovran (E. R.) & Piquett (P. G.). **Toxicity of Thiourea and Phthalonitrile to Housefly Larvae.**—*J. econ. Ent.* **36** no. 6 p. 936, 5 refs. Menasha, Wis., 1943.

In laboratory tests, thiourea [*cf. R.A.E.*, B **29** 133] and phthalonitrile both caused complete mortality of third-instar larvae of *Musca domestica*, L., when added to the breeding medium at the rate of 0·112 per cent. by weight, whereas twice as much borax was required to do so. Thiourea at 0·014 per cent. killed 86 per cent., while borax at 0·112 per cent. gave only 81 per cent. mortality and phthalonitrile at 0·028 per cent. gave 53 per cent.

Sullivan (W. N.), Schechter (M. S.) & Haller (H. L.). **Insecticidal Tests with *Phellodendron amurense* Extractive and several of its Fractions.**—*J. econ. Ent.* **36** no. 6 pp. 937–938, 4 refs. Menasha, Wis., 1943.

A petroleum-ether extract of the fruit of *Phellodendron amurense* dissolved in acetone solution gave 62 per cent. mortality of Culicine mosquito larvae in 18 hours, as compared with 6 per cent. given by derris (5·2 per cent. rotenone), when both were used at a concentration of 1 : 100,000. Chemical fractionation of the extract was carried out, and the scheme used and the relative toxicity to adults of *Musca domestica*, L., of each fraction when dissolved in acetone at a concentration of 50 mg. per ml. are shown in a table ; some of the fractions were much more toxic than the original extract, the most effective being a molecular distillate obtained at 100–150°C. Certain fractions were also tested against larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., but these tests did not give such sharply differentiated results. In other tests against house-flies, the extract killed an average of about 50 per cent. when dissolved in acetone at a concentration of 50 mg. per ml., but the kill varied considerably with different samples of fruit and also with its degree of maturity. When dissolved in a refined high-boiling kerosene, the extract gave negligible kill [*cf. R.A.E.*, A **32** 189], and since this is the solvent in most commercial fly-sprays, the use of extracts of *P. amurense* in such preparations does not appear to be practical.

A solution of a petroleum ether extract of *P. lavallei* in acetone, at a concentration of 50 mg. per ml. was about as toxic to house-flies as one of an extract of *P. amurense* [*cf.* **32** 190].

McGregor (T.) & Eads (R. B.). **Mosquitoes of Texas.**—*J. econ. Ent.* **36** no. 6 pp. 938–940, 1 map, 2 refs. Menasha, Wis., 1943.

Texas is divided for the purpose of this survey into 17 areas, and a list is given of the 54 species of mosquitos known to occur in the State, showing the area or areas from which each has been recorded, the time of year at which it breeds and its economic importance. The Anophelines recorded are *Anopheles quadrimaculatus*, Say, which transmits malaria, *A. albimanus*, Wied., *A. crucians*, Wied., *A. pseudopunctipennis*, Theo., and *A. punctipennis*, Say, which possibly transmit malaria, and *A. atropos*, D. & K., and *A. barberi*, Coq., which are of no economic importance.

Melvin (R.), Smith (C. L.) & Graham (O. H.). **Some Observations on Chiggers.**—*J. econ. Ent.* **36** no. 6 p. 940. Menasha, Wis., 1943.

The predominant species of chigger-mite in central Texas is *Trombicula* (*Eutrombicula*) *alfreddugèsi*, Oudm., which was taken on man, Angora goats, grey squirrels, fowls and other birds, horned lizards, armadillos and snakes. It is most abundant early in the spring and in the autumn along wooded stream beds, but it is also very plentiful during the hot, dry summer months in small isolated areas on high, brushy range land. This may be because goats, which

are occasionally so heavily infested that sores susceptible to attack by screw-worms [*Cochliomyia hominivorax*, Coq.] are produced, rest in the shade in such areas and infested birds nest and roost there. The exposure for 6–8 hours in suspected territory of chicks 2–3 weeks old, preferably of a white-skinned breed, was a satisfactory method of locating infested areas and determining trends of population. The length of the larval period on young chicks averaged 5·9 days with a maximum of 7, but on horned lizards collected in nature and infested on an unknown date, the average duration of the larval period after collection was about 30 days and the maximum 65 days. This maximum was on a horned lizard collected on 14th July. For the first few hours after they detach themselves from the host, the larvae crawl actively and can climb perpendicular glass walls, but by the end of the first day, they become quiet and make no effort to attach themselves to objects on which they are placed. In dry stoppered vials, they transform into nymphs after an interval of from three days to at least two months, but moulting can be induced overnight by the addition of a little moisture. The reaction in birds, goats and squirrels was very similar to that produced in man. Brief notes are given on the effect on the other hosts, which appeared to be less severe. *T.* (*Neoschöngastia*) *americana*, Hirst, was present on fowls in south-central Texas.

Kilgore (L. B.), Ford (J. H.) & Wolfe (W. C.). **Insecticidal Properties of 1,3-Indandiones. Effect of Acyl Groups.**—*Industr. Engng Chem.*, Industr. Edn., **34** no. 4 pp. 494–497, 1 graph, 16 refs. Easton, Pa., 1942. [Recd. 1944.]

The following is the authors' summary. The acylated 1,3-indandiones are very toxic to house-flies [*Musca domestica*, L.] when tested according to the Peet-Grady insecticide bioassay method. The profound effect of the various acylations upon the insecticidal properties of this series of new compounds provides an opportunity to study the relation between organic chemical structure and insect toxicity.

It was found that the insect toxicity of the acylated indandiones was increased as the number of carbon atoms in the acyl radical was increased from 2 to 5. Thereafter the activity towards flies decreased. The isomeric valeryl-1,3-indandiones exhibited powerful insecticidal action approaching that of the pyrethrins. However, their action is not sufficiently rapid for use alone in contact fly-sprays. Accordingly, their applications appear to be as a substitute for the major portion of pyrethrum extractives, especially in the more concentrated insecticides. The laboratory preparation of these new compounds is described as well as the details of the biological evaluation against house-flies.

Gould (G. E.). **Recent Developments in Roach Control.**—*Pests* **11** no. 12 pp. 12–13, 22–23, 24 refs. Kansas City, Mo., 1943.

This paper is largely a review of the recent literature on the control of cockroaches in the United States [*R.A.E.*, B **31** 100, 165, 198; **32** 74]. Practical tests of 2,4-dinitroanisole at 10 or 20 per cent. with pyrophyllite are reported [*cf.* **32** 74]. In one of them, a 10 per cent. mixture was considered less effective than sodium fluoride; in another, a 20 per cent. mixture was estimated to have reduced a heavy infestation of the German cockroach [*Blattella germanica*, L.] by about 80 per cent. in two weeks. Kill was satisfactory in two other cases, but in one of them it was considered slow. It has been suggested that the amount of sodium fluoride required for control might be reduced if it were suspended in some liquid and the mixture sprayed into the places where cockroaches hide, and M. Levenson reports good results from suspending sodium fluoride in a light oil. In preliminary tests as a dust mixed with pyrophyllite, 2,2-bis (parachlorphenyl)-1, 1, 1-trichlorethane (the chemical

also known as dichlor-diphenyl-trichlorethane [DDT]) showed rather low toxicity to *B. germanica*, particularly the females.

EDDY (G. W.) & JOYCE (C. R.). **The seasonal History and Hosts of the American Dog Tick, *Dermacentor variabilis*, in Iowa.**—*Iowa St. Coll. J. Sci.* **18** no. 3 pp. 313–324, 26 refs. Ames, Iowa, 1944.

The following is almost entirely taken from the authors' summary. Studies of the seasonal history and hosts of *Dermacentor variabilis*, Say, were carried out at the Tama Indian Reservation during April–December 1941 [*cf. R.A.E.*, B **32** 44], and supplemented by collecting at Ames in January–March 1942 to determine the spring emergence of the immature stages. More than 4,000 mammals and 266 birds were examined. The adults appeared to become active in the first week in April. The average numbers of adults per host on dogs in each month from April to October were approximately 40, 89, 28, 10, 0·8, 0·1 and 0·004. The last was taken on 9th October. Adults were also taken from the horse, cow, pig, cat, fox squirrel (*Sciurus niger*), woodchuck (*Marmota*) and racoon. The average number of larvae per host on *Peromyscus leucopus noveboracensis* (northern white-footed mouse) in April–November were approximately 32, 3, 1, 1, 1, 0·7, 0·2 and 0·01 and of nymphs 0·2, 0·7, 1·2, 0·9, 0·3, 0·1, 0·02 and 0·007. The last nymph was taken on 8th November and the last larva on 23rd November. From examples of this mouse examined in January–March 1942, the first larva was taken on 24th March and the only nymph on 31st. The numbers of larvae and nymphs found on other hosts were 7 and 1 on 92 prairie harvest mice (*Reithrodontomys*), 62 and 27 on 17 meadow mice (*Microtus*), 1 and 0 on 2 prairie jumping mice (*Zapus*), 1 and 0 on 1 house mouse (*Mus musculus*), 10 and 42 on 1,132 dogs, 349 and 52 on 56 cottontail rabbits (*Sylvilagus*), 188 and 8 on 22 cats, 6 and 8 on 24 fox squirrels, 0 and 1 on 11 woodchucks and 3 and 0 on 2 opossums (*Didelphis*). Investigation of infestation on various parts of the body of mice indicated that larvae prefer the head, especially the ears, while nymphs congregated about the neck, shoulders and forepart of the body.

DAVIS (G. E.). **Experimental Transmission of the Rickettsiae of the Spotted Fevers of Brazil, Colombia, and the United States by the Argasid Tick *Ornithodoros nicollei*.**—*Publ. Hlth Rep.* **58** no. 48 pp. 1742–1744, 2 refs. Washington, D.C., 1943.

The following is based on the author's summary and discussion. Examples of *Ornithodoros nicollei*, Mooser, that had engorged in the first nymphal stage on guineapigs infected with the spotted fevers of Brazil, Colombia and the United States, respectively, later transmitted the causal organisms to fresh guineapigs by feeding [*R.A.E.*, B **32** 138]. The rickettsiae of Brazilian and Colombian spotted fever were transmitted by larvae that were the offspring of infected females. Hereditary transmission of the spotted fever of the United States was not tested. Observations suggest that the larvae may be the most efficient transmitters, as they attach firmly, whereas ticks in later stages are easily dislodged, and evidence of infection is apparent earlier following larval feeding than feeding by the later stages. *O. nicollei* may be considered a potential vector of spotted fever in Mexico, where it is found on man and dogs [**32** 137] and the disease is probably present, although it has not been recorded [but *cf.* **32** 78].

HORSFALL (W. R.). **Biology and Control of Mosquitoes in the Rice Area.**—*Bull. Ark. agric. Exp. Sta.* no. 427, 46 pp., 4 figs., 30 refs. Fayetteville, Ark., 1942. [Recd. 1944.]

Mosquitos are serious pests in the rice-growing areas of Arkansas. Investigations on the species involved, extending over a period of two years beginning in

1937, were recorded in 1939 [*R.A.E.*, B **27** 257] and this bulletin deals with further observations of life-history and studies on control made between 1939 and the end of the 1942 season. The topography and soil of the region and the system of irrigation are briefly described, and notes are given on the biology of mosquitos in general, with particular reference to the distinction between those breeding in flood water and those developing in permanent waters. On the basis of catches of many thousands of adults made in light-traps of the New Jersey type [**31** 195] in 1939–41, it is estimated that 98–99 per cent. of the population in the experimental area was composed of *Psorophora confinnis*, Lynch (*columbiae*, D. & K.), *P. discolor*, Coq., *Anopheles quadrimaculatus*, Say, and *Culex erraticus*, D. & K., which formed respectively, 53, 36, 5 and 4 per cent. of the total. The adults and larvae of these four species and *P. ciliata*, F., are very briefly described, and the life-histories of *P. confinnis* and *A. quadrimaculatus* are given as typical of the species breeding in flood waters and permanent waters, respectively.

The salient features of the life-history of *P. confinnis* have already been noticed [**31** 93], but the information here given is in much greater detail. The females feed very frequently, usually taking three blood-meals before ovipositing the first time and one before each subsequent oviposition. Adults flew as much as 8·8 miles from the point where they were released. About eight times as many mosquitos were recovered within five miles of the points of release as beyond. More than three times as many females were collected in a revolving trap 4 ft. from the ground as in one 8 ft. from the ground, but males were more numerous at the higher level. No mosquitos were collected during the day. Of new rice-fields, those in which the presence of livestock had provided food for the adults during the preceding season contained the greatest numbers of larvae at the first flooding. The numbers of eggs laid, and consequently the numbers of larvae in the water at this time, may be kept down by preceding rice in the rotation scheme by soy beans or some other crop for which a dust mulch is used, or possibly by fallow, or, if rice is planted in the same field in two successive years, by delaying final draining in the first season until after mid-September. Thorough preparation of the seed-bed destroys large numbers of eggs. A miscible oil at as high a dilution as 4 parts per million gave complete control in field tests in 1942, and much greater concentrations than this can be used economically and without injuring the rice, but a method of applying the oil on a large scale has not been worked out, and it did not control *A. quadrimaculatus* as it had disappeared by the time that larvae of this species normally occur in a rice-field after reflooding.

A. quadrimaculatus is present throughout the year but most abundant from early June to early October. As many as six generations may emerge during the rice-growing season. Larvae were present for two-thirds of the time that the water was over the fields and were most abundant from mid-June to mid-July. Populated areas may be protected from *A. quadrimaculatus* by establishing around them a zone two miles wide in which no rice is grown. Control of the larvae by draining and channelling existing waterways, dusting with Paris green, using *Gambusia* and oiling all water in which rice is not growing is discussed.

BOLTEN (J.). **The Prevention of Malaria among the Military Forces in Puerto Rico.**—*Bol. Asoc. méd. P. Rico* **35** no. 3 pp. 89–96. San Juan, P. R., 1943.

The monthly number of cases of malaria among the military forces in Porto Rico in 1941 was between 40 and 85 per thousand from January to the end of July, 180 per thousand in August and 100–150 per thousand from September to the end of the year. The rate in 1942 was about double that for 1941 in the first six months but declined in the second six months until it was about half that for the preceding year. The death rate from malaria in Porto Rico was

125 per 100,000 in 1941 and there were indications that it might be even higher in 1942. The predominant parasite is *Plasmodium falciparum*, and the only important vector appears to be *Anopheles albimanus*, Wied. [*R.A.E.*, B **28** 91], although *A. grabhami*, Theo., and *A. vestitipennis*, D. & K., also occur. Transmission takes place throughout the year, but incidence is greatest between September and December. The principal Anopheline breeding places are sugar-cane fields, especially those in the lowlands with many drainage ditches, mangrove swamps behind the coastal dunes with less than 50 per cent. sea water, hoof prints in pasture lands, lakes and irrigation reservoirs if vegetation is allowed to develop in them, and man-made collections of water, especially those produced in the course of constructing military roads and buildings.

The control measures in use were dusting sugar-cane fields, marshes, etc., with a mixture of 2–10 per cent. Paris green and hydrated lime or calcium carbonate (powdered limestone), oiling with diesel oil, draining and filling, and experiments were being made on dusting from aircraft with 15–30 per cent. Paris green. As *A. albimanus* can complete its life-cycle in Porto Rico in 7 days, all larvicidal measures must be repeated at least once a week [*cf.* **17** 218; **20** 157]. Dipping to test the success of measures taken is carried out about one day after dusting or oiling, and breeding places are dusted twice a week if this is shown to be necessary. In lowland areas where dusting with Paris green is the chief measure, the numbers of adults have not decreased noticeably except during periods of dry weather, but in the more hilly country where minor drainage operations of a more or less permanent nature are being carried out, the numbers have been consistently reduced. The reduction effected in the index of prevalence of *A. albimanus* as ascertained by catches in animal-baited traps was not so great that it could be considered responsible for the great decrease in the incidence of malaria in the armed forces. This is attributed to the effect of improved screening of barracks and quarters, supplemented by spraying to kill mosquitos in them. Owing to local conditions, drainage is often necessary before larvicides can effectively be used on the remaining breeding places.

SOPER (F. L.) & WILSON (D. B.). *Anopheles gambiae* **in Brazil 1930 to 1940.**—$9\frac{1}{4} \times 6\frac{1}{4}$ ins., xviii+262 pp., 5 pls., 75 figs., 6 pp. refs. New York, N.Y., Rockefeller Foundation, 1943.

This monograph deals with the history of *Anopheles gambiae*, Giles, in Brazil from 1930 to 1940 and the organisation that was set up for its control in 1939 and eradicated it in less than two years. The main points have already been noticed from other sources [*R.A.E.*, B **31** 215, etc.]. The adults of *A. gambiae* of both sexes and the immature stages are described with notes on var. *melas*, Theo., as defined by Evans and Barber & Olinger [*cf.* **20** 64, 65]. This form was apparently not involved, but an adult of it was taken in an aircraft that arrived from Africa in October 1941. Data are given on the breeding requirements of *A. gambiae* as observed in Brazil and Africa, the length of time for which the eggs remain viable, its feeding and resting habits, and its close association with man and consequent great capacity for causing epidemic malaria. The discovery of the species at Natal in Rio Grande do Norte in March 1930 is then recorded, the method by which it was introduced and the possibilities of its spread are discussed, and Natal and its surroundings and the relevant aspects of the topography, climate and housing conditions of north-eastern Brazil are described. Subsequent sections deal with the immediate effect of the establishment of *A. gambiae* at Natal and of the control measures taken in 1931 and the first part of 1932, with its spread in these early years and the reasons for the failure to eradicate it at this time, with the five years (1932–37) during which its presence was scarcely noticeable and no serious outbreaks of malaria occurred, with its spread up river valleys in Rio Grande

do Norte and to Ceará and the resultant epidemics there in 1938, and with the surveys made and measures taken in that year.

A large portion of the book is devoted to the Malaria Service of the North-east, which assumed control of the situation in January 1939. Its legal basis and administrative organisation are explained, and translations are given in appendices of the decree organising it, the contract providing for the collaboration of the Rockefeller Foundation and the government, and a decree of May 1932, legalising certain measures, which was designed by the Yellow Fever Service for its own use and was found to be sufficiently comprehensive for the new organisation. A summary of the composition, activities and expenditure of the organisation is given, and the functions of certain special sections are briefly indicated. The development of its programme is traced through 1939 and 1940, and accounts are given of methods used in making surveys, the choice and application of measures for the control of *A. gambiae*, the measures taken to prevent its spread beyond the known infested area, naturally or by railway, road traffic, aircraft and boats, and activities after it had apparently been eliminated.

The extension and subsequent progressive diminution of the infested area in 1939 and 1940 are then described with reference to the control measures, and the spread and recession of malaria are also dealt with. Observations covering a year and a half, including two rainy seasons, after the suspension of control measures failed to reveal any indication of the presence of *A. gambiae*, and reasons are given for believing that this negative evidence indicated that it no longer existed in any of the previously known infested areas of north-eastern Brazil or in neighbouring districts. Finally, the threat to other American countries, the danger of reinfestation, the prevention of transport of dangerous Arthropods, the general aspects of species eradication, and the applicability of the Brazilian methods in Africa are discussed.

Williams (A. W.). **Local Derris Root for Scabies.**—*E. Afr. med. J.* **20** no. 12 pp. 396–398, 5 refs. Nairobi, 1943.

Three treatments on successive mornings with a suspension of derris in soap solution, worked to a foam on the skin and allowed to dry, gave good control of *Sarcoptes* [*scabiei*, Deg.] on man in Uganda. Mites on the clothes are believed to be killed by the treatment as well as those in the skin. The formula used was 1 oz. ground, locally grown derris root containing 2·32 per cent. rotenone in a solution of 2 oz. soft soap in 37 oz. water, with the addition of 20 grains borax and 0·5 oz. liquor potassae to improve the lather. Where there is much excoriation and thickening of the skin, the three applications are followed by three others of calamine lotion or ointment on successive days. If evidence of active scabies persists after this, the derris treatment is repeated for a further three days.

Papers noticed by Title only.

Augustson (G. F.). **Preliminary Records and Discussion of some Species of Siphonaptera from the Pacific Southwest** [Arizona and California].—*Bull. S. Calif. Acad. Sci.* **42** pt. 2 pp. 69–89, 45 refs. Los Angeles, Calif., 1943.

Fairchild (G. B.). **An annotated List of the Bloodsucking Insects** [excluding mosquitos], **Ticks and Mites known from Panama.**—*Amer. J. trop. Med.* **23** no. 6 pp. 569–591, 3½ pp. refs. Baltimore, Md., 1943.

Bhasker Rao (R.). **Experimental Control of** [*Anopheles culicifacies*, Giles, and] **rural Malaria at Pattukkottai, Tanjore District, S. India.** (Abstract.)—*J. Malar. Inst. India* **5** no. 1 p. 125. Calcutta, 1943. [*Cf. R.A.E.*, B **31** 220.]

ROBERTS (F. H. S.). **Observations on *Anopheles annulipes* Walk. as a possible Vector of Malaria. 1. The relative Susceptibility of *An. annulipes* and *An. punctulatus* var. *moluccensis* Sw. to experimental Infection with Malaria Parasites.**—*Aust. J. exp. Biol. med. Sci.* **21** pt. 4 pp. 259–262, 4 refs. Adelaide, 1943.

In 1942, G. A. M. Heydon showed that *Anopheles punctulatus* var. *moluccensis*, Sw. & Sw., is the important vector of *Plasmodium vivax* in the Cairns area of Queensland; it had previously been found to transmit both *P. vivax* and *P. falciparum* in New Britain [*R.A.E.*, B **12** 38] and to be the chief vector near Merauke in Dutch New Guinea. However, occasional cases of indigenous malaria in parts of Australia where it does not occur have suggested that *A. annulipes*, Wlk., may be a vector in these areas. This species was infected experimentally by Heydon some years ago and has been used in Western Australia for the transmission of *P. vivax* in malaria therapy, but it has never been associated with an epidemic of malaria in Queensland south of Townsville or in New South Wales, although it has had opportunities of becoming infected. Details are given of laboratory experiments involving several hundred females in which it was shown to be quite as susceptible as *A. p. moluccensis* to gut and gland infection with *P. vivax* and *P. falciparum*. A higher percentage of *annulipes* than of *moluccensis* fed on the donors, and there was no great difference between the percentages of the two that survived the 10–14 days between feeding and dissection. It is pointed out that such experimental findings as these cannot determine the epidemiological importance of a species without consideration of more important factors, but it is considered undesirable to concentrate large numbers of gametocyte carriers in places where *A. annulipes* is abundant unless adequate protective and control measures are carried out.

WOMERSLEY (H.) & HEASLIP (W. G.). **The Trombiculinae (Acarina) or Itch-mites of the Austro-Malayan and Oriental Regions.**—*Trans. roy. Soc. S. Aust.* **67** pt. 1 pp. 68–142, 12 pls., 18 figs., 59 refs. Adelaide, 1943.

This paper includes a brief discussion of the economic importance of the mites of the subfamily TROMBICULINAE, a key to the 19 genera recognised by the authors (of which two are new and a third receives a new name) and a revision of the species of the Austro-Malayan and Oriental Regions. The many new species described include *Trombicula fletcheri*, which occurs in Malaya and is thought to be the species recorded there as *T. akamushi*, Brumpt [*R.A.E.*, B **19** 97; **20** 179], and *T. hatorii*, which is the Formosan mite briefly described by Hatori [**8** 37] as *T. pseudoakamushi* (non Tanaka) and described and figured by Kawamura & Yamaguchi [**10** 41] as *T. pseudoakamushi* (non Tanaka) Hatori. In the section on economic importance, it is pointed out that though Trombiculine mites of several genera attack man and cause severe irritation, all those that are vectors of disease belong to the genus *Trombicula*, sens. str. *T. akamushi* is the recognised vector of tsutsugamushi disease in Japan and Formosa, and *T. deliensis*, Walch, probably transmits the same or an allied disease in Sumatra [**21** 145], Malaya [**20** 179; **28** 190, etc.], Queensland [**30** 53] and India [**26** 57]. The name *T. minor* var. *deliensis*, Walch,* is used for the mite that Gunther considered to be the vector of "endemic typhus" in New Guinea [**30** 51]. Gunther described it as *T. hirsti* var. *buloloensis* [but later concluded that it was identical with *T. minor*, Berl.].

* The name *deliensis* as applied to this form is preoccupied by Walch's species *T. deliensis*. The next available name for the variety is presumably *buloloensis*, Gunther. —*Ed.*

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As regards the nomenclature of the Japanese species [**18** 185], the author considers that *T. pseudoakamushi*, Tanaka, should be dropped from the literature, as it is a complex of at least two species for which valid names (*T. pallida*, Nagayo et al.) and *T. palpalis*, Nagayo et al.) are available, but he has been unable to ascertain the status of *T. tanakai*, Kishida, which may be an earlier name for *T. akamushi*.

WILLIAMS (W. L.). **On the Activity of the Tsetse,** *Glossina pallidipes* **and other Tsetse during a 24 Hour Period.**—*Rhod. agric. J.* **40** no. 6 pp. 368–370 2 refs., also as *Bull. Minist. Agric.* [*S. Rhod.*] no. 1249, 4 pp., 2 refs. Salisbury, S. Rhod., 1943.

On 28th–29th October 1943, continuous patrols, each of two hours' duration, were made over a period of 24 hours with a donkey near a pontoon across the Busi River in Portuguese East Africa about seven miles from the Southern Rhodesian border with the object of determining the diurnal and nocturnal activity of *Glossina pallidipes*, Aust., and comparing the findings with those of Vanderplank in Tanganyika [*R.A.E.*, B **30** 50] and Chorley & Hopkins in Uganda [**31** 89]. It was also intended to make incidental observations on the activity of *G. brevipalpis*, Newst., and *G. morsitans*, Westw. Only flies that alighted on the donkey were caught. The night was moonless. The fact that the largest catch was made in the last hour showed that the killing of tsetses during the patrol had little effect on the local population. In all, 42 males and 16 females of *G. pallidipes* were taken, nearly all between 5 and 8 a.m. and 5 and 6.20 p.m. South African Standard Time. Large numbers of *G. brevipalpis*, about 99 per cent. of which were males, were observed on the road between 5.48 and 6.30 p.m. and 5 and 6 a.m., but they were not greatly attracted to the donkey. Only two individuals of *G. morsitans* were seen, and these were the only tsetse flies taken between 10 a.m. and 5 p.m. Air temperatures during the hottest part of the day inhibited activity, but the night temperature was never low enough to do so.

DAVIDSON (J.). **The Time required for the Eggs of the Body Louse** (*Pediculus humanus corporis* **de Geer) to develop and hatch at different Temperatures.**—*Med. J. Aust.* 12th June 1943, repr. 4 pp., 1 graph, 2 refs. Sydney, 1943.

Under the conditions of temperature and humidity prevailing between the body and the clothes, the eggs of *Pediculus humanus humanus*, L. (*P. h. corporis*, Deg.) develop and hatch in about nine days. If clothing infested with eggs is left in a room, the eggs will hatch if conditions are suitable. They will not hatch at 60°F., but will remain viable for 2–3 weeks and develop and hatch when placed again at a favourable temperature. Data on the development of the eggs at various temperatures are given from work by H. S. Leeson [*R.A.E.*, B **30** 21], and it is estimated from them that the average percentages of development per day at 75·4, 78·8, 84·2, 89·6, 95·0 and 98·6°F., are 5·56, 6·90, 10·53, 13·33, 16·67 and 16·67, respectively. These values are fitted to a curve showing the relation of the velocity of development of the eggs to temperature as described in an earlier paper by the author [A **31** 421]. The observed values for the average development of the embryo per day at the five constant temperatures between 75·4 and 95°F. fitted the calculated curve well.

SIMPSON (R. E. H.). **Mites infesting Carcinoma of the Jaw.**—*Lancet* **246** no. 6301 p. 740. London, 1944.

A carcinomatous swelling in the gum of an edentulous woman was found to be infested by Tyroglyphid mites. Some of the mites were living, eggs were present

and quantities of excreta were found in the material from the deeper layers of the growth, indicating that the infestation was of long standing. Mites of this family commonly occur in cheese, flour and dried fruit.

MESSERLIN (A.). **Note sur l'emploi de l'arsénite de calcium comme poudre larvicide dans la lutte antipaludique.**—*Bull. Inst. Hyg. Maroc* (N.S.) **1** (1941) pp. 69–78, 1 ref. Rabat, 1943.

As oils could not be imported into Morocco at the beginning of 1941 and the manufacture of Paris green had been suspended in France, possible substitutes were tested for the control of Anopheline larvae, but only arsenical dusts showed any toxicity. When used in the laboratory with talc as the diluent, calcium arsenite proved more effective than erythrine (cobalt arsenate), a local mineral that has to be reduced to a powder and is very expensive, and lead arsenate gave poor results. At a rate equivalent to that at which Paris green is normally applied in the field (0·3 oz. per 100 sq. yards), calcium arsenite gave complete kill of third- and fourth-instar larvae in 48 hours, while Paris green gave complete kill in 24 hours, but when the rate was decreased, its effectiveness declined considerably. When Paris green alone, calcium arsenite alone and a mixture of calcium arsenite and Paris green (2 : 1) were compared in the field, all being applied, with powdered limestone as the diluent, by the methods normally used for Paris green, all gave complete control of third- and fourth-instar larvae, but neither is quite so effective against younger larvae. These results were confirmed in the employment of calcium arsenite in practical Anopheline control. The mixture with Paris green was used until the stock of Paris green was exhausted.

MESSERLIN (A.). **La lutte antipaludique au Maroc en 1941.**—*Bull. Inst. Hyg. Maroc* (N.S.) **1** (1941) pp. 133–145, 1 pl. Rabat, 1943.

In 1941, a severe epidemic of malaria occurred in Morocco and spread beyond the endemic zone to large areas usually free from the disease. The areas affected and the course and intensity of the epidemic, which varied considerably from place to place, are discussed. The contributing factors included heavy rainfall in the coastal area in the winter and spring and lack of immunity in certain sections of the population. Anophelines were abundant early in the season, but to varying extents in different regions ; there were as many as 50–100 per dwelling in April in some coastal areas. In July, Anophelines were found on the outskirts of some towns, although these were protected by a controlled zone just over 3 miles wide. It is rare for Anophelines to fly so far in Morocco. One coastal area was infested by females that must have originated in breeding places at least 5 miles inland. In the infected urban areas and in some others, there was a marked discrepancy between the large number of cases of malaria and the small number of Anophelines found. This may suggest that under the influence of certain atmospheric conditions, the *Plasmodium* increases in virulence in the body of the mosquito or the mosquito becomes better able to transmit it.

Difficulties in controlling the Anophelines included transport problems and lack of oil and Paris green. Calcium arsenite was used as a substitute larvicide [see preceding abstract], and anti-larval measures were successfully maintained and sometimes intensified over an area extending for over 3 miles around the large urban districts and principal rural centres of population. Outbreaks in these protected areas remained sporadic and involved only an insignificant proportion of the total population. In one centre of population around which

no anti-larval measures had been considered necessary, cases of malaria were very numerous from July to October.

[Netzkiĭ (G. I.).] **Нецкий (Г. И.). The Effect of low Temperatures on the Development of the Eggs of** *Anopheles maculipennis messeae* **Fall.** [*In Russian.*]—*Med. Parasitol.* **11** no. 5 pp. 24–29, 3 refs. Moscow, 1942. [Recd. 1944.]

In western Siberia, eggs of *Anopheles maculipennis* var. *messeae*, Flni., laid in spring are subjected to sharp fluctuations in temperature in April and the first half of May, and occasional frosts occur even in June. Experiments on their resistance to cold were therefore carried out from October 1940 to the end of March 1941 at Omsk. The eggs were obtained from females taken in hibernation quarters and fed on blood in the laboratory and were exposed to cold as soon as they were laid or 24 or 48 hours later by keeping them for 1–35 days on damp filter paper in the space between the two frames of a double window. The average temperature between the frames varied from 3·9°C. [39·02°F.] to —10·3°C. [13·46°F], the maximum was 15°C. [59°F.] and the minimum —18°C. [–0·4°F.]. After cooling, the eggs were kept on water at room temperature and their hatching was compared with that of eggs of the same batches that had not been subjected to cooling.

The majority of the eggs were viable after cooling, and they withstood the minimum temperature of —18°C. Adequate exposure to cold, however, produced an embryonic diapause, so that the period subsequently required for hatching was extended by up to 54 days. Its production and duration depended on the degree of cold and duration of cooling. It did not occur when the average cooling temperature was above 0°C. [32°F.], but was produced by exposure for five days or less to average temperatures below —2°C. [28·4°F.] and for longer periods to slightly higher temperatures. Observations on the eggs that were not subjected to cooling showed, however, that those of a given batch usually did not hatch simultaneously, as some developed at a normal rate, some exhibited an innate diapause, and some were incapable of development. The effect of cooling on these different categories of eggs needs special investigation.

In experiments under conditions similar to those of early spring in Siberia, in which freshly laid batches of eggs were placed in water and exposed for 6 hours daily to temperatures ranging from —1·3 to 6·5°C. [29·66–43·7°F.], and kept for the rest of the time at 19–20°C. [66·2–68°F.], the rate of embryonic development was not appreciably affected. This indicated that the natural fall of temperature after sunset to or below the threshold of development of the eggs does not interfere with embryonic development. On the contrary, daily cooling for several hours may sometimes accelerate development.

[Ivanova (L. V.) & Polovodova (V. P.).] **Иванова (Л. В.) и Половодова (В. П.). Observations on the Ecology of the** *Anopheles* **Larvae in the Lencoran Region.** [*In Russian.*]—*Med. Parasitol.* **11** no. 5 pp. 29–34, 2 graphs, 4 refs. Moscow, 1942. [Recd. 1944.]

An account is given of the topography and characters of the coastal plain in south-eastern Azerbaijan and the mountainous area on the west of it. The Anophelines found there during a survey from 29th July to 1st October 1937 comprised *Anopheles maculipennis*, Mg., which was represented by var. *typicus* in the mountains and foothills and var. *subalpinus*, Hackett & Lewis, in the plain, *A. hyrcanus*, Pall., which was found only in the plain and *A. claviger*, Mg. (*bifurcatus*, auct.), which was found in the mountains and not searched for in the plain.

The larvae of *A. maculipennis typicus* occurred chiefly in shallow water with a slow current and a gravel bed; the water was sometimes almost devoid of

vegetation and sometimes densely covered with filamentous algae, and varied greatly in degree of exposure to the sun. Those of var. *subalpinus* were found in open still water devoid of plants rising above the surface, but with abundant growths of plankton Lemnids and Elodeids ; they occurred in rivers where the water was motionless owing to the density of the algae. *A. hyrcanus* bred in still water shaded by vegetation rising above the surface and having a muddy bed, such conditions being afforded by rice plots if the rice was tall enough to provide shade and by old large water reservoirs overgrown with reeds, etc., and *A. claviger* was confined to heavily shaded springs devoid of aqueous vegetation.

Particulars are given of the temperatures and oxygen contents of the water in the various breeding places.

[Zhukov (N. M.) & Krasikova (V. I.).] **Жуков (Н. М.) и Красикова (В. И.). Epidemiological Rôle of *Anopheles maculipennis messeae* hibernating in Houses in Siberia.** [*In Russian.*]—*Med. Parasitol.* **11** no. 5 pp. 35-38, 1 fig., 1 graph. Moscow, 1942. [Recd. 1944.]

As it has been suggested in Siberia that mosquitos hibernating indoors may transmit malaria during the winter, investigations were carried out in a village in the Province of Omsk from 23rd December 1941 to 25th April 1942. The local houses have a raised floor, and the space beneath is used as a store room and entered through a trap-door. Females of *Anopheles maculipennis* var. *messeae*, Flni., were found in 62 out of 150 houses ; some were in living rooms or in the few warm animal quarters, but the majority were hibernating in the space under the floor, where the temperature fluctuated between 3·4 and 7·1°C. [about 38–45°F.]. They continued throughout the winter to penetrate into the living quarters of the houses through cracks in the floor and through the trap-door when it was left open, their numbers increasing towards spring. Thus, four were taken in one house in January, and 13, 27 and 42 in February, March and April. The temperature in the living rooms fluctuated between 14·7°C. in the morning and 25°C. in the evening [58·46–77°F.], and the mosquitos usually began to fly about and attack the inhabitants at dusk, continuing under conditions of artificial light, though some did so at dawn or during the day. They congregated on the ceiling or in places where they were hidden and on the soil in flower pots.

Examination of mosquitos collected daily in living rooms showed that the percentage containing blood increased from 5·4 in December to 28·1 in April. Some of the females taken in and after January had mature ovaries and were presumably capable of immediate oviposition, but about 30 per cent. of those taken in January and February were in the state of gonotrophic dissociation, which indicated that repeated feeding was needed to complete ovarian development. In rooms, the mosquitos probably oviposited on the soil in flower pots, as they often rested there and of ten females with developed ovaries, all laid eggs on damp earth with which they were confined. Of 1,080 mosquitos examined for malaria parasites, one contained sporozoites in the salivary glands ; it was taken at the beginning of March in a house in which a boy had suffered from malaria in the preceding October-November. The ability of malaria parasites to complete the extrinsic cycle in the winter-spring period under indoor conditions was proved by an experiment in which 31 out of 77 mosquitos fed on 21st March on a carrier of gametocytes of *Plasmodium vivax* and subsequently kept in a living room harboured sporozoites 33 days later.

It is concluded that malaria can be transmitted in winter and early spring in Siberian houses, and that mosquitos in them should therefore be destroyed after the ventilation openings in the foundation have been stopped up for the winter.

[Loginovskiĭ (G. E.).] **Логиновский (Г. Е.). The Hours of the Flying of *Anopheles maculipennis messeae* from Winter Shelters.** [*In Russian.*]—*Med. Parasitol.* **11** no. 5 pp. 38–45, 6 graphs, 1 fig., 9 refs. Moscow, 1942. [Recd. 1944.]

Observations on the time of day at which females of *Anopheles maculipennis* var. *messeae*, Flni., leave their hibernation quarters were carried out in a village on the river Kama near the town of Molotov from 5th April to 20th May 1941. Traps were placed in the ventilation openings of a basement in which the mosquitos were hibernating and were examined every hour after mosquitos began to be caught in them, and incidental records were made of the times at which mosquitos were seen to fly up through the trap-doors of the basement into the inhabited house above.

The observations, which are discussed in detail, showed that the mosquitos emerge from their hibernation quarters at any time from early morning until nightfall, but not during the hours of darkness. The peak of emergence occurred just before and after sunset (7–8 p.m.). The flight of the mosquitos was stimulated by the exhaustion of the fat-body and the onset of hunger, which also induced them to feed in bright sunshine, but light exercised a certain hindering effect, as most of them made their way out of the basement in subdued light in the evening, and this through the opening in the shaded eastern wall. The chief factor that governed the flight was adequate warmth outdoors, while wind [*cf. R.A.E.*, B **24** 265], relative humidity, or clouds had no essential effect.

Individual mosquitos flew from the basement to the warm rooms above from 17th April onwards, and 155 had been observed to do so by 18th May, 35 emerging on 8th May. The temperature on 17th April was lower in the open than in the basement. Emergence into the open did not start until 4th May, when the temperature and relative humidity were 6–8°C. [42·8–46·4°F.] and 100 per cent. out of doors and 3·2°C. [37·76°F.] and 76 per cent. in the basement. A female containing blood was taken indoors on 20th April, and one with completely developed eggs on 29th April. As such mosquitos might feed again after ovipositing in any water available in the rooms, they might transmit malaria from an infected person to other members of the household at a time when they could not survive in the open [*cf.* preceding abstract].

[Zhukov (V. M.).] **Жуков (В. М.). The Use of Anabasin-Sulphate (Aerosol) in the Control of Mosquitos** (*Anopheles maculipennis*). [*In Russian.*]—*Med. Parasitol.* **11** no. 5 pp. 48–50, 1 fig., 1 ref. Moscow, 1942. [Recd. 1944].

The aerosol produced by pouring a water solution of anabasine sulphate on quick-lime [*R.A.E.*, B **29** 27] was successfully used in the Province of Moscow in 1940 to destroy adults of *Anopheles maculipennis*, Mg., in cow-sheds and other shelters. Since, however, quick-lime was in short supply and the production of the aerosol by means of hot sand [*cf. loc. cit.*] involves the risk of the anabasine igniting, another method, suggested by E. A. Pogodina, was adopted. Small lumps of porous material (brick, clay, lime or chalk) soaked with anabasine sulphate were placed in a two-inch layer in a wire-gauze container, and the container was suspended inside a metal tube that formed the chimney over the flame of an ordinary kerosene lamp. The lower part of the tube had a glass window that enabled the operator to see the flame.

In the summer of 1941, 126 cow-sheds were treated by this method ; they were swept before treatment and the cracks in the walls and ceiling stopped with hay. The production of the aerosol began in 1½–2 minutes, but it dispersed more slowly than the aerosol produced by means of quick-lime, so that the mosquitos survived for at least 5 minutes and some made their way out into the open through remaining cracks, whereas the aerosol from quick-lime killed the

mosquitos in 1–2 minutes and none had time to escape. The method is, however, considered much more effective than sprays.

[Mironov (V. S.) & Baldina (A. I.).] **Миронов (В. С.) и Балдина (А. И.). A persistent Ulcer as a Result of the Bite of** *Ixodes*. [*In Russian.*]—*Med. Parasitol.* **11** no. 5 pp. 51–53, 3 refs. Moscow, 1942. [Recd. 1944.]

The habits of ticks when feeding on man, and the effect of their bites and saliva on the skin are briefly discussed [*cf. R.A.E.*, B **16** 46]. One of the authors has observed cases in which bites by several examples of *Ixodes persulcatus*, Schulze, in June and early July, followed by engorging for up to 5 hours, produced papules that disappeared after a time. Most of them, however, reappeared after 1½ months and three appeared a third time after 6 months, which indicated that the substances introduced by the tick into the skin of man persist at the site of the bite after the external symptoms have disappeared. An account is also given of a case in June 1939, in which irritation and papules were produced by the bites of several ticks, probably *I. persulcatus*, on the skin of a man engaged in forest work in the region of the river Kama, and an ulcer developed at the site of one of the bites that was not healed after 8 months.

[Trofimov (G. K.).] **Трофимов (Г. К.). On the Stage of Development of hibernating Larvae of** *Anopheles pulcherrimus* **Theob.** [*In Russian.*]—*Med. Parasitol.* **11** no. 5 pp. 85–87. Moscow, 1942. [Recd. 1944.]

As it appears that *Anopheles pulcherrimus*, Theo., hibernates in the larval stage in the Russian Union [*cf. R.A.E.*, B **29** 141 ; **31** 158, 160 ; **32** 117], investigations to ascertain the time of appearance of the overwintering larvae and the instar in which they hibernate were carried out in south-eastern Azerbaijan in 1937–38. Observations on the females showed that oviposition might occur in October or the first half of November, but not later [*cf.* **31** 158].

Anopheline larvae and pupae were taken in swamp water [*cf.* **28** 186] on 20th October 1937 ; the larvae, which included those of *A. pulcherrimus*, were all in the first and second instars, but the absence of older ones at this time may have been due to the recent treatment of the swamp with a larvicide dust. On 18th November, however, numerous larvae of *A. pulcherrimus* and *A. hyrcanus*, Pall., were taken in the same breeding place, and those of *A. pulcherrimus* all proved to be in the first, second or third instar, whereas those of *A. hyrcanus* were in the second, third and fourth and some had pupated. The average air temperatures in the last ten days of October and the first and second ten days of November were, respectively, 14·2, 13·4 and 11°C. [57·56, 56·12 and 51·8°F.]. Larvae of *A. hyrcanus* and *A. pulcherrimus* taken in the second instar on 18th November and reared at 19–22°C. [66·2–71·6°F.] pupated after 9–12 and 20–25 days, respectively. Anopheline larvae taken in the same swamp on 28th January, when the temperature of the water surface was 12°C. [53·6°F.], and on 26th February were exclusively third-instar larvae of *A. pulcherrimus*.

The author concludes that the larvae found in winter hatched from eggs laid in October or November, that the overwintering larvae appeared about 20th October, and that hibernation took place in the third instar.

[Shugar (N. A.).] **Шугар (Н. А.). A new Method of Preparation of Paris Green Suspension.** [*In Russian.*]—*Med. Parasitol.* **11** no. 5 pp. 87–88. Moscow, 1942. [Recd. 1944.]

As the petroleum oils used in the preparation of suspensions of Paris green for the control of Anopheline larvae in Russia [*cf. R.A.E.*, B **28** 37 ; **31** 60, etc.] are not available for this purpose in war time, experiments with various substitutes were carried out, and the oily acid water that is left in the vat when

tar is distilled from birch bark proved highly satisfactory. The suspensions were easy to prepare, as the definite ratio of the two materials required for suspending Paris green in oils was not necessary with the tar-water, and the suspensions made with it were more stable and did not break for 2–5 hours after dilution with water in the quantities usual for diluting kerosene suspensions. A suspension of 1 lb. Paris green in 4 pints tar-water, applied at the rate of 0·9 lb. Paris green per acre of water surface, gave complete mortality of Anopheline larvae and pupae in 3–10 hours. The suspension formed a delicate film, which became denser as the particles of Paris green freed themselves from the oils of the tar-water and rose to the surface.

Special experiments showed that the tar-water is itself toxic to mosquito larvae and pupae and is effective as a spray against adult mosquitos in houses.

Comparable results were obtained in tests with the water residue from the distillation of tar from pine wood, and the author believes that water obtained in the distillation of tar from other trees or peat would possess similar properties [*cf.* also **32** 2].

[Bozhenko (V. P.) & Yurchak (F. F.).] **Боженко (В. П.) и Юрчак (Ф. Ф.). Acclimatisation of** *Gambusia* (*G. affinis holbrooki*) **in East Kazakstan.** [*In Russian.*]—*Med. Parasitol.* **11** no. 5 pp. 90–91, 1 graph. Moscow, 1942. [Recd. 1944.]

Preliminary observations were carried out in 1938–40 in Semipalatinsk (north-eastern Kazakstan) on the possibility of acclimatisation of *Gambusia affinis holbrooki*, which was introduced there in 1935 and 1936, but did not survive the winter. A large consignment of the fish was received from Alma-Ata (southern Kazakstan) and liberated in May 1938. In October and November a section was partitioned off in each of three springs that would not freeze and stocked with several thousand fish, which were fed on fresh chopped meat. The sections were practically devoid of vegetation. No fish survived the winter in two of the sections, but the third contained 7 females and 2 males on 15th April 1939, representing 0·45 per cent. of the fish that had been released in it. The nine fish were liberated in a water reservoir in a pine forest and their numerous progeny effectively controlled Anopheline larvae.

In September 1939, two of the sections in the springs were stocked with fish from this reservoir and the progeny of others that had overwintered in the laboratory. None survived the winter in the section in which a few had survived the preceding one, but 30·3 per cent. (65 females and 26 males) survived in the other section. *Veronica anagallis* was growing in this section in the second year, and the survival of the fish, although the water was colder than in the first winter, is attributed to its presence, as it provided shelter for them and the content of free oxygen in the water was almost double that in the spring that was clear of vegetation.

[Khachumyan (Kh. R.).] **Хачумян (Х. Р.). On the Demodicosis in Man.** [*In Russian.*]—*Med. Parasitol.* **11** no. 5 pp. 92–93. Moscow, 1942. [Recd. 1944.]

Workers are not in agreement as to whether or not the mites of the genus *Demodex* that are responsible for mange in dogs, pigs and other animals are specifically distinct from *D. folliculorum*, Simon, and whether the latter is harmless or pathogenic to man. Divergent opinions on the second question are briefly reviewed, and notes are given on cases of infestation observed by the author in Baku. Of 200 patients (chiefly farm workers) in hospital for other diseases, 59·4 per cent. of the men and 29·6 per cent. of the women had the mites in the skin of the face without showing evidence of their presence, but 66 persons were observed in the course of 18 months in whom the infestation was accompanied by more or less severe symptoms. It appeared that prolonged

and severe infestation results in peculiar changes in the skin and sometimes in ulcerous inflammation of the eyelids so that the eyes are affected. In many cases, such symptoms were associated with disorder of the intestinal tract, liver or kidneys, pain in the joints, or certain changes in the blood, all of which ceased when the mites were eliminated.

It was found that they can be eliminated by rough daily scraping of the skin followed by the application of sulphur ointment, or, if the eyelid is infested, by squeezing them out and applying a solution of 1 part brilliant green in 53 parts alcohol mixed with 47 parts water.

Notes are given on the observed spread of infestation among members of a family, and it is suggested that it is acquired by close contact with infested persons or animals, or by using contaminated towels or other household articles.

[Sergiev (P. G.) & Yakusheva (A. I.).] **Сергиев (П. Г.) и Якушева (А. И.). Malaria Control in the USSR.** [*In Russian.*]—*Med. Parasitol.* **11** no. 6 pp. 3–10. Moscow, 1943.

[Beklemishev (V. N.).] **Беклемишев (В. Н.). The Study of Arthropods—Carriers of Diseases in the USSR for Twenty-five Years.** [*In Russian.*]—*T.c.* pp. 18–35.

These two papers comprise historical surveys of work carried out in the Russian Union since the establishment of Soviet government, and the first also includes details of the organisations concerned in the control of Anophelines and malaria.

[Ulitcheva (A. V.).] **Улитчева (А. В.). Anophelogenic Rôle of the various Types of Waters of a Rice Region.** [*In Russian.*]—*Med. Parasitol.* **11** no. 6 pp. 38–47, 7 graphs, 2 refs. Moscow, 1943.

To determine the possibility of controlling Anopheline larvae in the rice-growing area of the region of Samarkand (central Uzbekistan), observations on their ecology were carried out in a locality in the valley of the middle Zarevshan during the year 1939–40. Permanent breeding places were provided by a river, a swamp fed by springs, and drainage ditches, and summer ones by the rice-fields and irrigation ditches, and by small ponds in orchards, which are periodically replenished. The Anophelines found were *Anopheles maculipennis* var. *sacharovi*, Favr, which was the most common, *A. hyrcanus*, Pall., *A. claviger*, Mg. (*bifurcatus*, auct.), *A. algeriensis*, Theo., *A. pulcherrimus*, Theo., and *A. superpictus*, Grassi. They all bred in the rice-fields, which were flooded from May–June to the end of September. These covered an area of 346 acres, whereas the total surface of all other types of water was only about 25 acres, of which less than 5 acres offered favourable conditions for mosquitos.

A. m. sacharovi occurred in all the breeding places and was the only species present in the orchard ponds. In summer, however, 99·3 per cent. of the larvae were in the rice-fields, where they represented 95–99 per cent. of the total number of Anophelines. They were most abundant in July, and the adults in August and September. Notes are given on their distribution and that of the other Anopheline larvae in rice plots irrigated by the chain system [see next abstract]. In March–April, before rice was sown, *A. m. sacharovi* and *A. hyrcanus* bred in shallow river creeks well heated by the sun and overgrown with aquatic vegetation, in drainage ditches and in the swamp, where the shallow water was still free from dense vegetation and very clear. They bred in the creeks again in September–October, after the rice-fields had been drained. Larvae of *A. claviger* occurred throughout the year in the creeks, especially where the water was deep and cold, those of *A. algeriensis* hibernated in the creeks among vegetation slightly rising above the surface, and both were found in the drainage ditches and, in autumn, winter and spring, in the swamp. *A. pulcherrimus*

and *A. superpictus* bred in the creeks and irrigation ditches and, to a small extent, in the swamp.

It is concluded that, though the area of permanent breeding places is small, they are of great importance in the survival of the mosquitos, as they comprise the only places where larvae of *A. claviger* and *A. algeriensis* can hibernate and the first generation of *A. m. sacharovi* and *A. hyrcanus* can develop.

[Ulitcheva (A. V.).] **Улитчева (А. В.). Distribution of the Larvae of *Anopheles maculipennis sacharovi* through a Rice-field (Samarkand District).** [*In Russian.*]—*Med. Parasitol.* **11** no. 6 pp. 47–52, 3 graphs, 1 ref. Moscow, 1943.

Anopheles maculipennis var. *sacharovi*, Favr, which is the chief malaria vector in Central Asia, is the predominant Anopheline in the valley of the middle Zarevshan, where it breeds chiefly in rice-fields [see preceding abstract]. With the view to facilitating its control, the distribution of the larvae in the rice-fields was studied in 1933 and 1934, and again in 1938 and 1939, the observations being carried out from June to the end of September in 20 fields in two localities situated on opposite sides of the river.

The rice was irrigated by the chain system, by which the water from the irrigation ditch flows through a series or " chain " of 8–10 adjoining plots, each of an area of several hundred square yards, before reaching the waste-water conduit. The water, which is 4–6 ins. deep and has a steady slow current, is cool, fresh and clean at first, but becomes progressively less so as it passes through the series of plots, owing to the effects of insolation, soil, and the products of decomposition of the aquatic vegetation and metabolism of the animal fauna. In June–July, which is the hottest period of the summer, the mean day-and-night temperatures of the water in the first and last plot were 22–23°C. [71·6–73·4°F.] and 26–28°C. [78·8–82·4°F.] and the maxima 28–30°C. [82·4–86°F.] and 38–39°C. [100·4–102·2°F.], and the development of the rice in the first plot was retarded by 2–3 weeks. In August, however, the mean temperatures differed less (19–20°C. [66·2–68°F.] and 22–24°C. [71·6–75·2°F.]), and in September they were almost equal (about 17°C. [62·6°F.]) in all plots. Filamentous algae, among which the larvae of *A. m. sacharovi* occurred in masses, formed dense growths in the first plot up to the end of July, but were scarce in the last one. The numbers of larvae were greatest in the upper half of the first plot, fell sharply in the second plot, and decreased more gradually in the subsequent ones. The dependence of their distribution on the condition of the water was confirmed in an experiment in which their numbers in the last plot increased where water was admitted directly into it. The larvae were most abundant in June–July, at which period there were 8–24 times as many in the first plot as in the last. After this, the production of the larvae in the rice-fields decreased, and their numbers in the different plots gradually became approximately even. Though the adult mosquitos were most numerous in August, females in the state of gonotrophic dissociation began to appear in the second half of the month, and the rate of oviposition was consequently reduced.

Other Anopheline larvae were not numerous in the rice-fields. *A. hyrcanus*, Pall., which was the most abundant species, was distributed comparatively evenly over the plots ; *A. claviger*, Mg. (*bifurcatus*, auct.) occurred only and *A. superpictus*, Grassi, chiefly, in the first one ; *A. algeriensis*, Theo., thrived in the parts of all plots most overgrown with emergent vegetation ; and *A. pulcherrimus*, Theo., occurred chiefly in the last plot.

First-instar larvae and pupae of *A. m. sacharovi* were, respectively, 5–6 and 15–20 times as numerous in the first plot as in the last one, which indicates that the latter is both less attractive for oviposition and less suitable for survival of the larvae that hatch, and it is suggested that the observed distribution of the

larvae in the rice-fields may be taken into consideration when applying control measures.

[Ulitcheva (A. V.).] **Улитчева (А. В.). The Ecology of the *Anopheles* Larvae in Rice-fields of various Types in Uzbekistan.** [*In Russian.*]—*Med. Parasitol.* **11** no. 6 pp. 53–61. Moscow, 1943.

Several systems of cultivating rice are in use in Uzbekistan, and the fields can be classed under three different types, *viz.* : fields under running water that is supplied by a spring or river and may be clear, moderately turbid, or very turbid ; fields with slowly moving clear water fed by seepage ; and fields under still water. Moreover, the fields of any of these types may be irrigated by the chain system [see preceding abstract] or the single-plot system, in which the water passes through each individual plot separately from the irrigation ditch into the waste-water conduit. The characteristics of these types of rice-fields are discussed in relation to the prevalence of the larvae of the six species of *Anopheles* that occur in them [see preceding abstract], and the data are summarised in a table showing the source and initial colour of the irrigation water, the colour, clearness and temperature of the water in the first and last plots of a row, the respective density in them of green filamentous algae and blue-green algae, and the abundance of the larvae of the various species of *Anopheles*.

The plots in which *A. maculipennis* var. *sacharovi*, Favr, was most numerous had fresh and clear, or only slightly turbid water, with a maximum temperature of 28–30°C. [82·4–86°F.], the emergent vegetation was sparse and green filamentous algae were dense. The larvae were scarcest in plots having very turbid water with temperature above 30°C. and dense emergent vegetation. Their abundance in the fields and that of larvae of *A. superpictus*, Grassi, were in direct proportion to the proximity of inhabited places that provided day-time shelters and hibernation quarters for the adults. *A. superpictus* occurred chiefly in plots irrigated by seepage or spring water, of a temperature above 30°C., with sparse rising vegetation and well developed green and blue-green algae. It was least abundant in fields with very turbid water of surface origin, not fed by seepage, and with dense growths of tall vegetation. *A. hyrcanus*, Pall., thrived in plots with water of a temperature of about 25°C. [77°F.] and comparatively dense emergent vegetation, situated close to growths of reeds among which the adult mosquitos sheltered and hibernated. It was scarcest in plots with very turbid water of over 30°C., sparse or excessively dense emergent vegetation and no reeds nearby.

A. pulcherrimus, Theo., was most numerous in plots with stagnant yellow water of temperatures over 30°C., sparse emergent vegetation and dense growths of olive-brown cakes of blue-green algae floating on the surface. It was least abundant in plots with very turbid running water of a temperature below 30°C. and dense tall vegetation. Its presence depended on the proximity of waters, such as swamps of the type of lakes, suitable for the hibernating larvae. *A. claviger*, Mg. (*bifurcatus*, auct.) was concentrated in the parts of plots close to the entrance from the irrigation ditch of cold spring water of a temperature not exceeding 20–21°C. [68–69·8°F.] provided that swamps fed by springs and suitable for hibernation were near. It was scarcest in fields with very turbid water of a temperature above 20°C. and situated far from the hibernation swamps. *A. algeriensis*, Theo., was most abundant in fields with comparatively dense emergent vegetation and water of a temperature not exceeding 20–21°C.

The distribution of the different types of rice-fields and species of *Anopheles* in the Provinces of Samarkand and Khorzem and the Valley of Ferghana in Uzbekistan is discussed, and it is concluded that the mosquito population in the rice-fields could be reduced by agricultural measures. Thus, a system of

irrigation that would maintain stagnant water liable to overheating would suppress the development of *A. m. sacharovi*. Dense sowing of the rice would result in maximum shading of the surface of the water, which is unfavourable to the larvae of all six species of *Anopheles*. *A. pulcherrimus* and *A. superpictus* could be checked by early sowing to secure the maximum density of the plants at about the time of appearance of the larvae, and the abundance of *A. pulcherrimus* could also be reduced by drainage of the waters in which it overwinters, or by stocking them with *Gambusia*.

[Shishlyaeva-Matova (Z. S.).] **Шишляева-Матова (З. С.). Comparative Study on the salivary Glands of the Culicinae of the Samarkand District. First Communication. Histology and comparative Morphology of the salivary Glands.** [*In Russian.*]—*Med. Parasitol.* **11** no. 6 pp. 61–66, 5 figs., 9 refs. Moscow, 1943.

A detailed study was carried out of the salivary glands of a large number of mosquitos, which were either taken in the environs of Samarkand or bred in the laboratory there. The laboratory mosquitos were dissected either immediately upon emergence or at different periods afterwards. Descriptions are given of the external morphology of the glands, which was studied in both sexes of nine species, four of the genus *Anopheles*, and of the minute structure, which was studied only in females of *A. maculipennis* var. *sacharovi*, Favr. It was found that the salivary glands of mosquitos vary greatly in shape and size, partly owing to the functional condition of the gland as a whole. The Anophelines did not show specific differences in the morphology of the glands, but differed from the other mosquitos in that the lateral lobes were spirally twisted. No atrophy of glands during diapause was observed.

[Levinson (L. B.).] **Левинсон (Л. Б.). On the Reservoir of Oriental Sore.** [*In Russian.*]—*Med. Parasitol.* **11** no. 6 pp. 80–83, 17 refs. Moscow, 1943.

It has been shown by Latuishev & Kryukova that gerbilles (*Rhombomys opimus* and *Meriones* spp.) and a ground squirrel (*Spermophilopsis leptodactylus*) are reservoirs of cutaneous leishmaniasis in the sandy plains of Central Asia [*cf.* next abstract], and since the large Transcaspian hedgehog, *Hemiechinus albulus major*, inhabits the burrows of these rodents and is thus closely associated with the sandflies (*Phlebotomus*) that breed in them, preliminary investigations were carried out in 1942 to ascertain whether it also is liable to infection. Data from the literature show that it is widely distributed in the foci of cutaneous leishmaniasis, occurring in a great variety of habitats, including towns, orchards and fields near dwellings, and that its burrows harbour species of *Phlebotomus* that are vectors of the disease, the sandflies emerging from them in numbers up to the middle of May. Of 20 examples of this hedgehog taken in March and April in the environs of Ashkhabad, one was found to have an incipient infection, evidently acquired earlier in the spring, a small number of typical leishmania bodies being present in smears of blood from the thickened edge of one ear.

[Latuishev & Kryukova.] Latyschew (N. I.) & Kriukowa (A. P.). **Die Rolle der Sandfliegen in der Aufbewahrung des Virus der Hautleishmaniose während des Zeitraums zwischen Epidemien.** [The Part played by Sandflies in the Preservation of the causal Organism of Cutaneous Leishmaniasis during the interepidemic Period.]—*C. R. Acad. Sci. URSS* **30** no. 1 pp. 90–92. Moscow, 1941. **Versuch zur Sanierung eines endemischen Herdes von Hautleishmaniose in Turkmenien.** [An Attempt to eliminate an endemic Focus of Cutaneous Leishmaniasis in Turkmenistan.]—*T.c.* pp. 93–96, 11 refs.

Investigations in the desert regions of Turkmenistan in 1937–38 showed that the burrows of ground squirrels and gerbilles serve as the sources from

which cutaneous leishmaniasis (*Leishmania tropica*) is transmitted to man, but the manner in which the organism survives between epidemics was not known. It was thought possible that it might do so in the sandflies (*Phlebotomus*) that occur in the burrows if they transmit it in any way to their progeny, or that it might survive the winter in the skin lesions of the rodents, until the sandflies resume activity. The first hypothesis was considered unlikely, since in previous work herpetomonads (leptomonads) had not been found in the gut of male sandflies, as they should have been if infection is transmitted hereditarily or acquired by sandfly larvae while feeding, though other flagellates (*Chilomastix* and *Bodo*) and bacteria, as well as Nematodes, frequently occurred in the intestines of adults of both sexes. In experiments in 1939, adults were reared from eggs laid by 130 of a large batch of females of *P. papatasii*, Scop., and *P. caucasicus*, Marz., that had been taken in the burrows of gerbilles and of which an average of 23 per cent. harboured herpetomonads. The females oviposited in test-tubes and in some cases those that died were left in the tube to serve as food for the larvae. The progeny obtained were 202 males and 328 females, and none of these was found to be infected. Furthermore, no parasitic cysts were found in the excreta of 150 female sandflies of both species, so that it is unlikely that the larvae become infected through contamination. The examination of preparations of the head and body of sandflies to determine the location of the herpetomonads in the digestive tract showed that they were practically always present in the œsophagus and also occurred in the intestine, which indicated that they infected the anterior part of the tract as flagellates, but did not occur as cysts in the posterior part. These findings are considered to confirm the view that the organism is not transmitted by infected females to their progeny.

In a further experiment, newly emerged females of *P. papatasii* and *P. caucasicus* were allowed to feed on two gerbilles that were spontaneously infected with cutaneous leishmaniasis. The only one to survive for more than a week, however, was a female of *P. caucasicus*, which died on the eighth day. Herpetomonads were found in its intestine, and it is concluded that sandflies become infected through feeding on diseased animals, that the herpetomonads found in their intestines actually represent developmental stages of *Leishmania*, and that *P. caucasicus*, like *P. papatasii*, is a host of *L. tropica*. This sandfly is not greatly attracted to man, however, and its part in the dissemination of the disease is probably restricted to maintaining it among rodents.

When sandflies were allowed to feed on the shaved backs of two infected gerbilles, of which the ears, the only part that showed lesions, were rendered inaccessible by covering them with varnish, none of the seven females that were subsequently dissected was found to be infected, but in view of the small numbers involved, this experiment is not considered conclusive.

In the second paper, the authors state that investigations in the Murghab valley in 1938 showed that ground squirrels and gerbilles are the local reservoir of the disease, and an account is given of an experiment in which the number of infections with the moist form (pendinka) of cutaneous leishmaniasis in a labourers' camp was greatly reduced by fumigating all the burrows in the area with chlorpicrin to destroy the rodents. The dwellings in the camp were being fumigated with chlorpicrin against bugs [*Cimex*] at the time, and as a result of both measures, sandflies became scarce. This type of treatment would not, however, be effective in towns, of which Askhabad is cited as an example, since the burrows of wild rodents in the environs are apparently not the only source of infection. Cases of the disease occur in all parts of this town, and it is thought that the sandfly vectors breed in the town itself and acquire the infection there. In one instance, a survey of the outskirts of a town in which cutaneous leishmaniasis occurred, showed that the rodent burrows in the immediate vicinity were far too few to be considered a factor in the spread of the disease. Cutaneous leishmaniasis in Askhabad is chiefly of the dry type. The causal

agents of the two types of the disease have been shown to differ immunologically, and it is suspected therefore that the dry form, associated with towns, and the moist one, associated with rural conditions, may represent distinct diseases.

COOLEY (R. A.). *Ixodes neotomae*, **a new Species from California (Acarina : Ixodidae).**—*Pan-Pacif. Ent.* **20** no. 1 pp. 7–12, 2 figs. San Francisco, Calif., 1944.

Descriptions are given of the adults of both sexes and the nymph of *Ixodes neotomae*, sp. n., a tick closely allied to *I. spinipalpis*, Nutt. [*cf. R.A.E.*, B **31** 176]. It was taken on rodents, chiefly wood rats (*Neotoma*) in California.

POWER (M. E.), MELNICK (J. L.) & BISHOP (M. B.). **A Study of the 1942 Fly Population of New Haven.**—*Yale J. Biol. Med.* **15** no. 5 pp. 693–705, 7 figs., 11 refs. New Haven, Conn., 1943.

In view of the possible importance of flies as vectors of poliomyelitis [*R.A.E.*, B **29** 195; **30** 93, 115], a limited survey of the fly population of one small part of New Haven, Connecticut, was made in the summer of 1942, a year in which there was no epidemic in the neighbourhood. Traps baited with raw liver, dog faeces, fish or banana with sugar were set out in a sheltered place, exposed to the sun, at intervals of five yards from 9 a.m. to 4 p.m. three times a week irrespective of weather from 25th June onwards. One hundred individuals from each catch of each trap were identified, and one day's samples from June, July, August and September were tested for poliomyelitis virus, with negative results. The catch was much greater in July than in any other month and fell away to nothing in November. No causal relationship between catch and weather could be traced. A classified list is given of the species identified. The dominant species throughout the greater part of the summer was *Lucilia* (*Phaenicia*) *sericata*, Mg., which sometimes comprised 85–95 per cent. of the identified flies. In the last days of September and throughout October, it was largely replaced by *Calliphora erythrocephala*, Mg., *C. vomitoria*, L., and *Cynomyia* (*Cynomyopsis*) *cadaverina*, R.-D. The prevalence of some other species is discussed. Although, with a few exceptions, each species entered traps containing all four kinds of bait, each was definitely more attracted to one kind than to the other three. Closely related species showed the same preferences. *Lucilia sericata* preferred liver, the flies prevalent in October preferred fish, and *Musca domestica*, L., was the only species that preferred banana.

WIESMANN (R.). **Fly Control in Stables. Use of " Gesarol " or the new " DDT " in the Control of Stable Flies.**—*Soap* **19** no. 12 pp. 117, 119, 141, 143. New York, N.Y., 1943. (Translation of **Eine neue Methode der Bekämpfung der Fliegenplagen in Ställen.**—*Anz. Schädlingsk.* **19** no. 1 pp. 5–8. Berlin, 1943.)

The principal disadvantage of the usual methods of controlling flies in animal sheds in Switzerland is their lack of residual effect. Numerous large scale tests showed that various species of flies are killed in a short time by contact with deposits of Gesarol [a spray concentrate containing 5 per cent. 2 2-bis (para-chlorphenyl)-1, 1, 1-trichlorethane, commonly known as DDT]. In one experiment, which is described as an example of this, the bottoms and covers of petri dishes were sprayed with 1 per cent. Gesarol and five freshly caught

adults of *Musca domestica*, L., were put into each dish after the deposits had completely dried. Flies were transferred to untreated dishes after exposure for 0·5, 1, 2, 5, 10, 20 and 60 minutes, and the effect was observed. There was none at the time of transference. Primary paralysis occurred 40 minutes after the shortest exposure and 10 minutes after the others. Secondary paralysis occurred in 6 hours and 35, 30–35, 30, 25–30, 20 and 20 minutes after the various exposures and death in 35, 8, 7–8, 6, 5, 3–4 and 3–4 hours, respectively. Results with *Stomoxys calcitrans*, L., were substantially the same; paralysis set in later, but death occurred after about the same time. The dry deposits on glass retain their potency for at least three months. The chemical acts as a neurotoxin, and the paralysis begins in the legs of the flies because the chemotactic sensorial organs in the tips of the tarsi come into direct contact with the deposit. In view of the results of the preliminary tests, the walls and ceilings of a shed containing ten cows and two heifers were thoroughly sprayed with 1 per cent. Gesarol on 20th June 1942. There was a large manure pile near the shed in which *M. domestica* and *S. calcitrans* were breeding in enormous numbers, and thousands of flies of these two species could be counted on the walls and ceilings before spraying. The cows were very restless. While spraying was in progress, the flies dropped to the ground immediately and soon died. The shed was free from flies every morning until 10th July; 100–200 had entered by evening, but had been destroyed by morning. It remained practically free from flies until 25th July, although a slight decrease in effectiveness was becoming noticeable on 18th. The cows were quiet throughout this period and milk yield increased. On 1st August nearly 1,000 flies were counted in the shed, and a second application of spray was made. Two applications, thus timed, will give protection for the whole fly season.

Thomssen (E. G.) & Doner (M. H.). **Livestock Insect Control. A Study of Insects which attack Livestock and Means for their practical Control.**—*Soap* **19** no. 11 pp. 96–97, 99, 101, 103, 117, no. 12 pp. 131, 133, 135, 137, 139, 141, 1 fig., 43 refs. New York, N.Y., 1943.

In the first part of this paper, a list is given of the common Diptera that attack livestock in the United States, followed by a discussion of the various ways in which they harm the animals and a review of measures for their control. In the second part, the crawling Arthropods (chiefly lice, mites and ticks) that attack livestock are similarly dealt with, but the list is arranged by hosts and shows in many cases the duration of the egg stage, the number of days required to reach maturity and the average number of eggs deposited. The section on control includes a list of 21 formulae for dips, showing the pests against which they are effective, the number of times the animals should be dipped and the intervals between dippings, and in many cases the authorities that recommend them.

Crombie (A. C.). **On the Measurement and Modification of the Olfactory Responses of Blowflies.**—*J. exp. Biol.* **20** no. 2 pp. 159–166, 4 figs., 28 refs. London, 1944.

It has been suggested that the native primary blowflies in Australia acquired the habit of attacking living sheep because they became accustomed to the smell of damp or soiled wool during the great droughts when the carcasses of sheep formed a large part of the carrion on which oviposition normally occurred. Although evidence seems to support the belief that serious attack on living

sheep followed the spread of the introduced blowflies, *Lucilia cuprina*, Wied., and *L. sericata*, Mg., it was decided to investigate the degree to which the responses of blowflies to odour could be modified by their past experience as larvae or adults [*cf. R.A.E.*, A **26** 1; **27** 264]. The species used were *Calliphora erythrocephala*, Mg., and *L. sericata*.

The conditions of the experiments and the methods of controlling and measuring the strength of the olfactory stimuli are described. Balancing olfactory and visual stimuli of different intensities demonstrated that a reasonably accurate control of the intensity of the olfactory stimulus was being achieved. The chief conclusions drawn on the quantitative relation of stimulus to response are given, but it did not appear easy to make theoretical deductions. Menthol, which is normally repellent to the flies, was used in tests of the modification of their response by past experience. Flies of both species developed from larvae that had been reared on an artificial medium containing 0·2 per cent. of menthol, *Calliphora* derived from larvae that had spent the period between the end of feeding and pupation on sawdust through which air containing 10 per cent. of menthol-saturated air was passed, and flies of both species that emerged into an atmosphere containing 2 per cent. of menthol-saturated air were found to have acquired a tolerance to the smell of menthol, which they gradually lost after a few days in an atmosphere free from it. The modification had disappeared before the end of the preoviposition period, but tolerance of less repellent odours might last longer. Adults that were first exposed to the odour of menthol a week after emergence did not subsequently show any tolerance to it. The change in response after exposure in the larval stage apparently resulted from memory of larval experience persisting through metamorphosis. An experiment is described showing that it cannot be attributed to the contents of the Malpighian tubes reaching the ecdysial fluid and becoming spread out over the inner surface of the puparium. It is shown that populations of flies that have been subjected to menthol are not homogeneous, but are divided by the treatment into sections differing in their responses. It is possible that such behaviour may lead to genetic isolation and to the formation of biological races. The change in behaviour usually appeared to be habituation, but in the case of the individuals subjected to menthol as post-feeding larvae, there was slight evidence that the flies had become conditioned, their behaviour having changed from negative to positive. The possible explanation of this is discussed. Habituated and control flies were equally repelled by 100 per cent. menthol-saturated air. No difference was observed between the responses of the two sexes in any experiment.

Papers noticed by Title only.

Machado (O.). **Catálogo sistemático dos animais urticantes e peçonhentos do Brasil.** [Systematic Catalogue of the urticating and stinging Animals of Brazil (including 41 insects, 5 mites and a tick).]—*Bol. Inst. Vital Brazil* no. 25 pp. 41–64, 192 refs. Niterói, 1943.

Rees (D. M.). **A new Mosquito Record from Utah** [*Mansonia perturbans*, Wlk.] (**Diptera ; Culicidae**).—*Pan-Pacif. Ent.* **20** no. 1 p. 19, 2 refs. San Francisco, Calif., 1944. [*Cf. R.A.E.*, B **23** 82; **31** 2.]

Jack (R. W.). **The Life Economy of a Tsetse Fly** [exemplified by *Glossina morsitans*, Westw., in S. Rhodesia].—*Rhod. agric. J.* **41** no. 1 pp. 25–38, also as *Bull. Minist. Agric.* [*S. Rhod.*] no. 1252, 15 pp. Salisbury, S. Rhod., 1944. [See *R.A.E.*, B **31** 40.]

GRAHAM (N. P. H.). **Some Observations on the Bionomics of the Itch Mite (*Psorergates ovis*) of Sheep and its Control with Lime-sulphur Dips.**—*J. Coun. sci. industr. Res. Aust.* **16** no. 4 pp. 206–214, 3 refs. Melbourne, 1943.

Psorergates ovis, Womersley, has been identified from Queensland, New South Wales, western Victoria and Tasmania [*cf.* also *R.A.E.*, B **32** 125]. It has been observed only in merino flocks, but this is probably because no extensive survey has been made of other sheep. Studies of the fluctuation of the mite population were made by examining scrapings from points chosen at random on the sides of affected sheep. White oil proved a satisfactory vehicle for the scrapings. Several must be taken over a fairly long period for negative results to be reliable. The rate of reproduction appeared to be slow, as no appreciable increase of population was seen on lightly infested sheep over a period of 12 months. When patches on the side of a heavily infested animal were cleared of mites, they did not become reinfested from the surrounding skin for several weeks. Brief accounts are given of several experiments on the transmission of the mites from one sheep to another, which showed that they migrate readily from machine-shorn sheep to other sheep, whether shorn or not, but that when the originally infested sheep is woolly, the mites migrate much less readily and several months are required for transmission to be effected. When infested and uninfested sheep were shorn alternately with the same machine and the groups then isolated, there was no evidence that the uninfested sheep acquired mites.

Heavy infestation usually occurs in sheep that have not been dipped for some years. To test the effectiveness of the usual sheep dips, infested areas on the sides of sheep were swabbed with a solution of sodium arsenite at a concentration equivalent to 0·2 per cent. arsenic trioxide, a 1 per cent. suspension of colloidal sulphur, a suspension of derris extract containing 0·005 per cent. rotenone, or lime-sulphur solutions containing 0·4 or 0·2 per cent. (weight in volume) polysulphide sulphur. All treatments reduced the numbers of mites, but the stronger lime-sulphur was the only one that gave complete kill [**32** 81]. As it was anticipated that the polysulphide content of a dip would fall during treatment, it was decided to use a solution containing 1 per cent. polysulphides for field test with the addition of Agral 3 to improve wetting. In a laboratory test with a solution of this strength containing 0·03 per cent. Agral 3, satisfactory wetting of sheep carrying $\frac{1}{4}$–$\frac{3}{8}$-inch wool was obtained in 30 seconds, control of the mites was complete and there was no apparent harm to the fleece. The field test was carried out with a dip made up of 100 gals. water and 5 gals. lime-sulphur concentrate guaranteed to contain not less than 20 per cent. polysulphide sulphur with the addition of 6 oz. Agral 3 [**32** 81, 125]. About 10,000 sheep shorn six weeks earlier were dipped in November 1941, including an experimental flock of 50 sheep, all of which showed the effects of irritation and rubbing. On examination before dipping, 5 showed no mites and 27, 6 and 12 had light, medium and heavy infestations, respectively. Scrapings from the most heavily infested sheep contained 117 adults and 283 larvae. After the passage of over 6,000 sheep, the polysulphide sulphur content of the dip had only fallen to 0·616 per cent. The experimental sheep were isolated after dipping. No mites were found on the sides of any of these sheep 7 days after dipping, though some were dipped when the polysulphide content was 0·616 per cent., but live mites were found on the backs of the heads of three sheep that had been heavily infested. This was probably the result of failure to wet the heads thoroughly. The heads of these three sheep were again examined 11 weeks and 8 months after dipping, and the sides of all the experimental sheep 4 and 11 weeks and 8 months after dipping, but no mites were found. These sheep were shorn but not dipped in the spring of 1942. A visual examination made in March 1943 revealed no signs of infestation.

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Bennison (J. C.). **Demodicosis of Horses with particular Reference to Equine Members of the Genus** *Demodex*.—*J. R. Army vet. Cps* **14** nos. 2–3 pp. 34–49, 66–73, 1 graph, 7 figs., 20 refs. Aldershot, 1943.

In view of the paucity of data in the literature on the effect on horses of infestation by mites of the genus *Demodex* [*R.A.E.*, B **5** 180; **7** 158; **8** 220], the subject was investigated at the Royal Army Veterinary Corps Laboratory at Aldershot. Details are given of the technique used for demonstrating the presence of the mites and examining them. A consistently elongated form was found in material obtained from the eyelids of 17 out of 132 horses, and the same form was demonstrated in the muzzle of 2 out of 56 of the same horses; in both of these positive cases, the mite was present in the eyelids also. This long form had never been found in skin scrapings submitted to the laboratory over a period of twenty years. Mites morphologically distinct from these were found in 81 out of 1,108 deep skin scrapings from other parts of the body. Records of microscopic examinations carried out at the laboratory over the period 1922–41 inclusive showed that the presence of this form had been demonstrated in 393 out of 4,355 skin scrapings. The morphology of the adults of the two mites is dealt with comparatively. The one from the eyelids and muzzle does not appear to have previously been described, though E. Wilson recorded mites from the secretion of the Meibomian glands of a horse in 1844, which he considered identical with the species [*D. folliculorum*, Simon] that infests man. The one from the skin scrapings [*D. equi*, Raill.] has been studied, probably the most comprehensive description being by S. Hirst in a paper already noticed [**7** 127]. The two forms are designated in this paper *D. folliculorum* var. *equi* and *D. equi*, respectively.

The elongated form was found in both the upper and lower lids of certain horses, but not necessarily in both in any one subject. It was confined to the ducts and tissue of the Meibomian glands. Both young and adult forms, including eggs, were found in the secretion of these glands, and there is strong evidence that both sexes occur in the gland tissue. Microscopical examination of scrapings from the skin of infested eyelids failed to reveal mites in any stage. It is inferred that both sexes remain in the gland tissue and that movement is below the superficial layers of the skin. The egg, larva and nymph are described. The other form (*D. equi*) was never detected in the eyelids or muzzle. The withers, neck and quarters were the most commonly infested sites. Deep scrapings were necessary to demonstrate its presence. Although the squeezing effect of scraping with a blunt scalpel may press the mites out of superficial sites such as the exits of the ducts of skin glands, it appears that this method may not be reliable in exposing those situated in the deeper sites, such as the hair follicles and sebaceous gland tissue.

It is shown from the literature that both the mites referred to have been considered the cause of abnormality in the horse, but the evidence of their pathogenicity is slight. Data obtained in these observations are given. In only one of the 17 positive sets of eyelids did superficial examination show any abnormality. In this case, the skin round one eye was somewhat scurfy and had lost some hair. Microscopical examination of tissue from three sets of eyelids that had shown particularly heavy infestation revealed the presence of the mites in the tissue and ducts of the Meibomian glands, but gave no evidence of active inflammatory change; some mites inhabited the space normally occupied by the alveolar cells and their contents, which it is thought may be ingested. The host responded by the formation of cyst-like structures with walls of varying thickness encircling and closely following the outline of the mites. No inflammatory change was noticed in infested muzzle tissue.

Most of the horses from which the skin scrapings containing *D. equi* were taken showed pruritus, but mites were found in skin scrapings from two out of 145 apparently normal horses, though one of the two developed pruritus seven

days later. Observations covering 20 years showed that mites can be found throughout the year, but the percentage of positive scrapings was greatest in July and August. The lesions on infested horses fall into two groups, a squamous, benign type and a papular or pustular type, each of which is described. Both are accompanied by pruritus. They were sometimes seen separately, though scurfiness is often associated with the latter. Lesions of the pustular type on infested horses were compared with similar lesions, apparently simple acne, on horses on which no mites could be found. The differences noted were the absence of pruritus in horses not infested by mites and a difference in the reaction to skin scraping. Field observations and two experiments failed to yield any evidence that infestation with *D. equi* is contagious. It is thought that this is because the mites, like others of the same genus, probably live in the sebaceous glands and hair follicles. The difficulties of assigning a definite pathogenic role to *D. equi* as a cause of skin lesions are summarised. In the absence of other evidence, the lesions are probably attributable to irritation caused by the mite. Vitamin and sun-ray deficiency and rubbing by rugs are apparently not involved, as infestation is most severe in summer, and the position of some of the lesions was not compatible with friction by harness or saddlery. There was some evidence that debility and sickness predisposed to pruritus accompanied by infestation by *D. equi*, but some cases occurred in horses in good condition. Very limited bacterial investigations of papules and pustules showed that the latter may be due to infection by staphylococci, either as primary or secondary invaders. The papules were negative. Histological examination, by serial sections, of tissue from two horses positive for *Demodex* failed to reveal the presence of the mite in the papules or pustules. It is inferred that it will probably be necessary to carry out extensive sectioning of the skins or hides of infested horses showing abnormality before the mite and the reaction of the host to infestation are demonstrated. It is concluded that under certain conditions, thought to be those favouring scurfiness and dirt, *D. equi* probably evokes a reaction in the host manifested by pruritus.

In September 1941, infested horses were clipped and the affected parts were washed with soap and water. The whole body was then vigorously brushed with sodium hyposulphite [thiosulphate] in 60 per cent. solution with warm water, allowed to dry and brushed vigorously all over with 10 per cent. hydrochloric acid, and the horses were exercised until dry. This treatment was repeated on the whole body after three days and on areas showing lesions after a further three days. The horses were washed with warm water three days after the last dressing. In most cases, the treatment was effective and pruritus disappeared, but in three instances, *D. equi* was found in skin scrapings afterwards, and in two of them it was accompanied by pruritus. In dirty and scurfy horses harbouring *D. equi*, adequate exercise with sweating and grooming is reported as having effected cures, and it is thought that a combination of this procedure with efficient dressing may be the best treatment.

Wiesmann (R.). & Fenjves (P.). **Autotomie bei Lepidopteren und Dipteren nach Berührung mit Gesarol.** [Autotomy in Lepidoptera and Diptera after Contact with Gesarol.]—*Mitt. schweiz. ent. Ges.* **19** no. 4–5 pp. 179–184, 1 fig. Berne, 1944.

In the course of experiments with Gesarol, which acts chiefly as a contact poison, small numbers of adults of *Operophtera* (*Cheimatobia*) *brumata*, L., *Sitotroga cerealella*, Ol., and *Culex pipiens*, L., were put in petri dishes bearing a dry deposit of the active ingredient [2, 2-bis (parachlorphenyl)-1, 1, 1-trichlorethane]. This was not powdery and so was not rubbed off the tarsi of the insect on to the other parts of the body. All the treated insects made violent movements

and cast a number of legs ; they became paralysed within a few hours and died, *Operophtera* and *Culex* within 48 and 12 hours, respectively. It is concluded that contact of the tarsal sense-organs with the deposit irritated the nerves of the legs and also the locomotive centre so severely that the legs were discarded in an attempt to escape the source of irritation, and that this irritation was the cause of paralysis and death.

PEMBERTON (C. E.). **Insects and other Arthropods of medical Interest in Hawaii.** —*Hawaii med. J.* March–April 1943 pp. 191–194, 1 ref. [Honolulu] 1943.

A list is given of the mosquitos, fleas, mites and other Arthropods of possible importance in connection with public health in Hawaii, with very brief notes on their habits.

[**Papers on Mosquito Control.**]—*Mosq. News* **3** no. 4 pp. 127–151, 15 figs. New Brunswick, N.J., 1943.

These papers include one entitled " Four Days in the Muskeg " (pp. 127–130), in which H. H. Stage gives an account of a four-day march made in July 1943 by 16 men carrying all their equipment under military conditions into typical muskeg [bog] country in northern Canada to test the effectiveness of mosquito repellents and other protective field equipment. The vast numbers of mosquitos met with were all of the genus *Aëdes* and they were active at dusk when the temperature was high enough as well as during the 20 hours of sunlight each day. Records are given of the species seen in July and during June. The muskeg and tundra extend for 3,000–4,000 miles from east to west and at least 1,000 miles from north to south and contain innumerable pools fed by melting ice. Practically no signs of animals on which mosquitos could feed were observed during the mosquito season in much of the area visited. Most of the observations were made near the northern limits of tree growth.

The equipment taken included sleeping bags designed to give protection from mosquitos without the aid of a tent, but they were not entirely satisfactory as it was difficult to obtain sufficient air without allowing an opening that would admit the mosquitos. A pup tent with doors of mosquito-netting and canvas was satisfactory once it was closed, but so many mosquitos gained access while the two occupants were crawling in that aerosol bombs [*R.A.E.*, B **31** 136] had to be used. These were very successful. Repellents, which are not specified, were found to be superior to head nets and heavy clothing.

In " Underground Drainage for Malaria Control " (pp. 137–142), N. H. Rector, T. A. Randle & H. L. Fellton briefly describe the underground drains used by LePrince and Gorgas in Panama more than 30 years ago [*cf.* **3** 108] and give a list of materials that may be employed in the construction of these drains, which are inexpensive to install, require little or no maintenance and obviate the necessity for inspection and larvicidal work. Underground drainage is one of the most effective methods of permanently eliminating Anopheline breeding places caused by seepage. Seepage outcrops are described, and the principles of the construction of underground drains designed to eliminate seepage areas are explained. This type of drainage may also be used to sub-drain open earth ditches and concrete inverts, stabilise ditch banks, drain marshes caused by springs, and provide outlets for overflow from drinking fountains and artesian wells. Their application to most of these uses is discussed.

The other papers include " References to Literature of Interest to Mosquito Control Workers," by H. H. Stage (pp. 146–151).

DAVIES (R. A.). **Observations on the Breeding of** *Anopheles* (*Anopheles*) *claviger*, **Meigen.**—*J. trop. Med. Hyg.* **46** no. 6 pp. 71–76, 6 figs., 6 refs. London, 1944.

Eggs of *Anopheles claviger*, Mg., were easily obtained in winter in the Lebanon coastal area from wild females kept at outdoor temperatures, but pairing had never been observed in the laboratory in covered cages or cages exposed to daylight or ordinary artificial light. In view of N. H. E. Gibson's success in inducing mating by *Spaniotoma minima*, Mg., in a small bell-jar or glass box with suitable lighting directly above, below or all around, it was decided to attempt to induce pairing in *A. claviger* and obtain fertile eggs by lighting the cages [*cf.* also *R.A.E.*, B **28** 85]. The larvae from which the culture was started were obtained from wells during November and December 1942. The source of light was a 25-watt clear glass lamp in a rectangular iron bench-lamp holder, and the cages were of netting on a wooden frame measuring $1 \times 1 \times 5$ ft. In the first experiment, 7 males and 7 females were introduced into the cage, which was resting on one of the long sides. After a few days, the females were fed on human blood, and the lamp was then placed against the end of the cage and switched on as it grew dark. Pairing was soon observed and occurred on three successive evenings. Raisins and damp cotton-wool were placed in the cage and further blood-meals given. Eggs that later proved to be fertile were found 12 days after lighting. Mating behaviour was similar when the cage was placed on end with the light at the top, and in all subsequent experiments, the cage was kept horizontal. Pairing was observed when the light was screened with cellophane, blue-painted cellophane or waxy tracing paper, but not when it was screened with used typewriter carbon paper. Tracing paper was used over the light in all later work, as without it, the flight of the males was occasionally interrupted when they flew near the light. A sheet of white paper was placed on the floor of the cage to facilitate observation. The number of eggs found on the first day on which any were seen in each of the first two experiments was about 60–70. These were divided into three batches, for rearing at different temperatures. Biscuit and yeast tablets were supplied as food for the larvae, and the bacterial and fungous film that formed was broken up by spraying water on the surface. A second generation was reared from the adults produced by a batch reared at 19·5°C. [67·1°F.], the females being fed on rabbit blood and the immature stages kept at 18°C. [64·4°F.]. Eggs of the third generation were also obtained and at the time of writing the larvae hatched from them had reached the second instar. The approximate durations in days of the egg, larval and pupal stages were 4, 25 and 4 at 18°C., 6, 24 and 4 at 19·5°C., and 10, 39 and 10 and 13, 55 and 8 at fluctuating temperatures with averages of 11·9°C. [53·42°F.] and 10·5°C. [50·9°F.], respectively. On one occasion, while the mosquitos were flying about because the rabbit was being placed in the cage, an abortive attempt at pairing was observed. This was the only known instance of attempted pairing without lighting.

About a dozen eggs of each generation from the constant temperature batch were examined. Those of the first generation all conformed to the type figured as *A. claviger* by Marshall in a paper already noticed [**26** 229]. There were two types among the sample of the second generation, the frill of the eggs of the second type resembling that of the egg figured by Marshall as *A. algeriensis*, Theo. First-instar larvae from these eggs conformed to those shown as *A. claviger* by Marshall with slight variations, which are indicated, and the fourth-instar larvae were identifiable with *A. claviger* in every respect. Examination of the pelts of 50 larvae of the first generation showed that they conformed to *A. claviger* as described by all authorities to whom reference was made, but with a number of minor variations. A general description of the larvae, with the principal variations, is given.

Ghosh (G.). **Malaria in Bengal—a scientific Problem.**—*Sci. & Cult.* **9** no. 11 pp. 495–499. Calcutta, 1944.

From the point of view of malaria, Bengal is divided into three geographical zones. The first is the foot-hill region in which *Anopheles minimus*, Theo., is the vector and control may be effected by flushing streams and channels by means of sluices or automatic siphons [*cf.* *R.A.E.*, B **29** 7] or otherwise raising the rate of flow at the edge of the water courses to more than 0·29 ft. per second [**29** 68-69]. Subsoil drainage can also be used to a limited extent. The second zone comprises the inland plains and deltaic regions where the vector is *A. philippinensis*, Ludl. [**27** 209; **31** 238], which breeds in reservoirs, ponds, borrowpits, etc. [**29** 19]. Species sanitation is facilitated by the fact that not more than 3–30 per cent. of the breeding places contain immature stages of the Anopheline at any one time, but the only cheap, permanent and successful method of controlling malaria in the deltaic areas appears to be flushing the land with silt-laden flood water, thus more or less restoring the conditions that existed before embankments were built to prevent flooding [**27** 7–8]. The third zone consists of the coastal regions and tidal areas where the vector is *A. sundaicus*, Rdnw. It breeds in water collections reached by spring tides but not flushed by daily tides. The recommended control measure is the construction of channels serving to flush the breeding places at high tide and effect drainage at low tide. A formula is given for calculating the necessary width and cross section of a proposed channel from its slope and the area to be drained.

Puri (I. M.). **Synoptic Tables for the Identification of the full-grown Larvae of the Indian Anopheline Mosquitoes.**—*Hlth Bull.* no. 16 (*Malar. Bur.* no. 7) 4th edn. (revd.) 109 pp., 83 figs. Delhi, Manager of Publications, 1941. Price 1*s.* 3*d.* [Recd. 1944.]

In this revision of a bulletin already noticed [*R.A.E.*, B **19** 72], the advanced key that forms part of the early editions is omitted, and only one main key is given, including all the species of *Anopheles* recorded from India, Burma and Baluchistan of which the larvae are known. In place of the advanced key, there are supplementary notes on the various species with keys to varieties. Some alterations have been made in the main key to simplify its use. As there are certain species that appear to be restricted to particular areas, five separate keys are given for Baluchistan, North-West Frontier Province and Sind; Delhi Province and the Punjab; Central India and Rajputana; Peninsular India and the United Provinces; and Eastern India and Burma. These geographical divisions are purely arbitrary. Characters found to differentiate a large majority of the larvae of *A. sundaicus*, Rdnw., and *A. subpictus*, Grassi [*cf.* **27** 64; **32** 152] are incorporated for the first time.

Causey (O. R.), Deane (L. M.) & Deane (M. P.). **An illustrated Key to the Eggs of thirty Species of Brazilian Anophelines, with several new Descriptions.**—*Amer. J. Hyg.* **39** no. 1 pp. 1–7, 2 pls., 9 refs. Lancaster, Pa., 1944.

Batches of eggs laid by more than 28,000 isolated female Anophelines from the Amazon Valley and the north-eastern and eastern coastal regions of Brazil were studied, and the subsequent stages were reared from some of them. They were found to represent 29 species of *Anopheles*, including *A. gambiae*, Giles, which is no longer present in Brazil [*R.A.E.*, B **32** 159], and one species of *Chagasia*, *C. rozeboomi*, sp. n., which was taken in Ceará and of which stages other than the eggs are to be described in a subsequent paper. A key is given to the eggs of these 30 species, based primarily on the floats, frills and pattern of the exochorion, and the eggs of *C. rozeboomi*, *A. kompi*, Edw., *A. nimbus*,

Theo., *A. peryassui*, D. & K., *A. mattogrossensis*, Lutz & Neiva, *A. shannoni*, Davis, *A. fluminensis*, Root, *A. minor*, Costa Lima, and *A. parvus*, Chagas, are described for the first time. Some variations in the eggs of several species are also described. A table shows the numbers of batches of eggs obtained from the various species and the localities in which they were taken. Adults of three additional species of *Anopheles* were found in the area, but eggs were not obtained from them.

Kumm (H. W.) & Zúniga (H.). **Seasonal Variations in the Numbers of *Anopheles albimanus* and *A. pseudopunctipennis* caught in Stable Traps in central America.**—*Amer. J. Hyg.* **39** no. 1 pp. 8–15, 3 graphs, 9 refs. Lancaster, Pa., 1944.

Data on the seasonal variations in the abundance of the prevalent species of *Anopheles* were collected on the Pacific coasts of Costa Rica between 1938 and 1940 and of Salvador between 1940 and 1942, by means of stable traps [*R.A.E.*, B **23** 302] baited with horses or mules. The species that most frequently entered the traps were *A. albimanus*, Wied., and *A. pseudopunctipennis*, Theo. [*cf.* **31** 74, 75]. In Costa Rica, 9,440 adults of *A. albimanus* were taken and only 92 of *A. pseudopunctipennis* [*cf.* **28** 220]. The former was most abundant during the rainy season, particularly in July, and there was a lag of about 30 days between the period of greatest rainfall and the subsequent peak in its density. Only 657 adults of *A. albimanus* were caught at San Salvador, most of them towards the end of the rainy season. *A. pseudopunctipennis*, of which 2,802 individuals were taken, increased in numbers with the dry season and reached its maximum prevalence in or about January. The principal airport of Salvador and a highly malarious village are both near Lake Ilopango. A trap operated for 22 months beside the airport caught 545 adults of *A. albimanus*, which was most abundant in November, at the close of the wet season, and 1,779 of *A. pseudopunctipennis*, which was predominant in the dry season, particularly March. However, in a trap on the shore of the lake, close to the village, 19,516 adults of *A. albimanus* were caught in 14 months, the greatest numbers during November and December, and only 162 of *A. pseudopunctipennis*.

Data obtained by workers in the Panama Canal Zone show that *A. albimanus* is most abundant there in June and malaria most prevalent in June or July. In the course of a malaria survey [**31** 74], the percentages of the admissions over a period of four years to a hospital in San Salvador that were attributable to malaria were found to be highest in December and January, about a month after the peak of production of *A. albimanus*, and lowest during March, April and May. No convincing evidence was found that *A. pseudopunctipennis* is responsible for transmission in Panama, Costa Rica or Salvador.

Bugher (J. C.), Boshell-Manrique (J.), Roca-García (M.) & Osorno-Mesa (E.). **Epidemiology of Jungle Yellow Fever in eastern Colombia.**—*Amer. J. Hyg.* **39** no. 1 pp. 16–51, 3 maps, 5 figs., 21 refs. Lancaster, Pa., 1944.

The history of jungle yellow fever in Colombia is reviewed [*R.A.E.*, B **23** 150 ; **26** 143, 187 ; **27** 139, etc.], and a detailed account is given of investigations carried out from the laboratory at Villavicencio since March 1938 and principally during an epidemic that broke out in 1940, on the behaviour of yellow fever virus in vertebrates and on possible Arthropod vectors. The susceptibility of monkeys [**24** 35 ; **25** 229, etc.] was confirmed, and it was also found that all Colombian marsupials [opossums] are susceptible, though to a varying degree. It was shown that jungle yellow fever may be maintained among populations composed almost entirely of monkeys or of marsupials or including both. Apparently no serious illness is produced in the susceptible animals. Animal sera taken during an earlier outbreak showed the track of the epidemic through

the monkey and marsupial populations, and the regions of greatest incidence in man corresponded with those of high immunity among animals of these groups. Although some mammals other than primates or marsupials were susceptible and protection tests in wild examples were sometimes positive, there was no evidence that they played a significant part in the spread of the virus in nature. It was demonstrated that there is no mammalian reservoir. All animals in which the virus can multiply develop specific antibodies, and virus disappears from the blood stream when the amount of these substances rises and does not subsequently reappear.

The general plan of the tests on Arthropods is outlined, and the methods of catching, feeding and triturating mosquitos, washing and sterilising glassware, etc., in the field and transporting animals and equipment and the nature of the equipment are described. A chronological account is then given of field and laboratory studies made at various points in 1940–42, following the occurrence of one or more cases of yellow fever in the immediate neighbourhood. The modification of the insect population of the forest at the beginning of the dry season was very rapid, mosquitos quickly becoming scarce. The virus was demonstrated 13 times in *Haemagogus capricorni*, Lutz (*janthinomys*, Dyar) [*cf.* **30** 77] and once in *Aëdes leucocelaenus*, Dyar & Shannon. It was not found in any other Arthropod. Two groups of naturally infected females of *H. capricorni* transmitted the virus to rhesus monkeys by biting. It was found that this mosquito, like the monkeys and marsupials, is primarily arboreal and exists in large numbers in the tree-tops when very few individuals can be found near the ground [see next abstract]. When a tree was felled, great numbers of the females were observed to attack the workers viciously. They persist in the foliage through the dry season, sometimes harbouring the virus, and may thus provide a means of carrying it over from one wet season to another. They constitute the true reservoir. Little is known of the breeding habits of *H. capricorni*. The larvae have been found in tree-holes only and in numbers that often do not seem commensurate with the adult population. The species can thrive wherever there is shade. In one instance the virus was repeatedly isolated from it in a region that was undisturbed by man until after the third demonstration of the virus, when a non-immune individual who entered the area became infected. The animals in this area were largely marsupials.

It is concluded that the basis of the epidemiology of jungle yellow fever is the transmission of the virus among monkeys and marsupials by jungle mosquitos capable of sustaining it, and that the chief of these in the llanos of Colombia is *H. capricorni*. The human element is usually casual. Where the human population is fairly high, *H. capricorni* may transmit from man to man, thus producing rural yellow fever. Two viruses other than that of yellow fever were also isolated in mice, one from a group of Sabethines and one from *Anopheles* sp.

BATES (M.). **Observations on the Distribution of diurnal Mosquitoes in a tropical Forest.**—*Ecology* **25** no. 2 pp. 159–170, 1 fig., 15 refs. Lancaster, Pa., 1944.

The following is almost entirely based on the author's summary. *Haemagogus capricorni*, Lutz, which is presumed to be the chief vector of jungle yellow fever in eastern Colombia [see preceding abstract], has been found to be more abundant in the forest canopy than at ground level. In captures at ground level, it is more abundant in open and dry places in the forest than in damp, heavily shaded ones. It is again relatively scarce above the general level of maximum density of the forest canopy. Its zonal distribution is most marked during the wet season, and it becomes relatively more abundant at ground level towards midday on a clear day, after a succession of clear days and during the dry season. From these data it would seem that avoidance of zones of high relative humidity may be the determining factor in the flight orientation of the mosquito.

Each species of diurnal mosquito found in the forest seems to have a particular type of flight distribution ; several, including *Psorophora ferox*, Humboldt, prefer ground level, four, including *H. capricorni* and *Anopheles boliviensis*, Theo., prefer canopy levels, and two or more species of *Aëdes*, including *A. leucocelaenus*, Dyar & Shannon, show a random distribution. Diurnal mosquitos also show two types of daily activity cycle, the *P. ferox* type, with morning and afternoon peaks of activity and the *H. capricorni* type, with maximum activity at midday. In general, the diurnal mosquitos that do not have a strongly metallic coloration fly more commonly in the lower strata of the forest and show a decline in activity during the midday hours. The only clear exception to this rule was *Anopheles boliviensis*. Though different species with metallic coloration showed different types of flight distribution, the author is inclined to the theory that metallic coloration is an adaptation to life under relatively adverse conditions of temperature and humidity.

Lindquist (A. W.) & Deonier (C. C.). **Seasonal Abundance and Distribution of Larvae of the Clear Lake Gnat.**—*J. Kans. ent. Soc.* **16** no. 4 pp. 143–149, 1 fig., 4 refs. Manhattan, Kans., 1943.

To obtain data on larvae of *Chaoborus astictopus*, Dyar & Shann., samples of mud were taken at 15 collecting stations from the bottom of Clear Lake, California, twice a month from January 1939 to November 1941. Details are given of the average bottom temperature and relative turbidity of nine stations on each sampling date throughout the period. Temperature was uniform over the greater part of the lake, and no correlation was found between turbidity and larval distribution. Larvae were found in numbers wherever samples were taken, except in the shallow water near the shore, and tended to increase gradually in abundance with the depth of the water, except for a short period in June when mature overwintered larvae concentrated near shore and occasionally in the summer when immature larvae became abundant there. Samples did not indicate that pupae were most abundant near the shore, but emergence was always greatest in that area [*R.A.E.*, B **31** 138]. Over 80 per cent. of the larvae were usually in the upper 4 inches of mud. The average number of larvae and pupae per sample taken at the 15 stations at each collection between 25th April, when adult emergence was beginning, and 25th October, when the overwintering population reached its peak, in each of the three years is given in a table. The figures show that great differences in population, no doubt principally attributable to weather, occurred from month to month and from year to year. These fluctuations are discussed.

Hodgen (B. B.). *Aëdes aegypti*, **Linnaeus, the Yellow Fever Mosquito, in Oklahoma.**—*J. Kans. ent. Soc.* **16** no. 4 p. 154. Manhattan, Kans., 1943.

During the second half of September 1943, four females and one male of *Aëdes aegypti*, L., were found among a collection of mosquitos from east central Oklahoma. This species had not previously been recorded so far west at such a northerly latitude. Investigations failed to reveal the presence of larvae.

Hungerford (H. B.). **The Tropical Rat Mite in Kansas.**—*J. Kans. ent. Soc.* **16** no. 4 p. 154. Manhattan, Kans., 1943.

Mites that attacked man in a house in Kansas early in 1943 proved to be *Liponyssus bacoti*, Hirst, which had not previously been recorded in this State.

Brown (J. H.). **Sylvatic Plague : the Recovery of Fleas from the Burrowing Owl and its Burrow in a Plague Area in Alberta.**—*Ent. News* **55** no. 1 pp. 15–18, 4 refs. Philadelphia, Pa., 1944.

Observations made in 1940–1942 in connection with the Alberta sylvatic plague survey [*cf. R.A.E.*, B **32** 9] showed that the burrowing owl, *Speotyto cunicularia*, was unusually abundant in a south-eastern area where plague was epizootic in *Citellus richardsoni*. The relation of the owl to the rodent fleas is discussed [*cf.* **27** 205 ; **30** 37]. In the epizootic area, it feeds on ground squirrels that die on the surface of the ground and always takes them to its nest before doing so. In the three years, 84 fleas were recovered from four owl burrows and found to be negative for plague and two out of 15 owls that were shot harboured one flea each, of which one was *Ceratophyllus* (*Oropsylla*) *idahoensis*, Baker, and the other was tentatively identified as *Rectofrontia fraterna*, Baker.

Shelanski (H. A.). **Toxicity Studies on Insecticides.**—*Soap* **20** no. 2 pp. 107–109, 133. New York, N.Y., 1944.

Recommendations based on practical experience are made for determining the toxicity of an insecticidal substance to man before it is put on the market. According to the nature of the substance and the use to which it is to be put, tests should be made of the effect on animals of ingesting a single, large dose or smaller, repeated doses, of inhaling a spray, vapour or aerosol for short or long periods, or of having deposits on the skin and eye, and on the effect, if any, of the substance as a primary irritant or sensitising agent on the human skin.

Finally, the response of a representative group of unselected human subjects to exposure to the material under the conditions of actual use should be observed. The number and kind of experimental subjects to be used in the various tests and the nature and duration of the observations to be made are indicated, and the necessity for controls is pointed out. The material in ingestion tests should be passed through a tube directly into the animal's stomach to ensure that a correct dosage is taken.

McGovran (E. R.) & Fales (J. H.). **Activated Pyrethrum Mosquito Spray.**—*Soap* **20** no. 2 pp. 117, 119, 3 refs. New York, N.Y., 1944.

The addition of sesame oil [*R.A.E.*, B **31** 148] or isobutylundecyleneamide [**31** 48–49] as an activator to pyrethrum sprays in a kerosene base considerably increases their toxicity to *Musca domestica*, L. An account is given of experiments with adults of *Aëdes aegypti*, L., 3–6 days old to determine whether they would increase the toxicity of the sprays to mosquitos. The tests were carried out in a Peet-Grady chamber, which was ventilated after an exposure period of 5 minutes. Counts of mosquitos knocked down were made 15 minutes after the beginning of the test and mortality counts after 16–24 hours. The percentage of females killed by a spray containing 0·033 mg. pyrethrins per ml. was increased in one series of tests from 54 to 62 by adding 0·19 mg. isobutylundecyleneamide, to 76 by adding 3 mg. sesame oil, and to 92 by doubling the concentration of pyrethrins, and in a second series, it was increased from 58 to 79 by adding 4·4 mg. isobutylundecyleneamide, to 70 by adding 45·8 mg. sesame oil, and to 82 by doubling the concentration of pyrethrins. The difference required for significance at 19 : 1 was 12·7 in the first series and 12·6 in the second. Males were more susceptible than females. The increase in toxicity effected by the activators was not so great as it has been reported to be in the case of *M. domestica*, but as most sprays of this type are used to control both house-flies and mosquitos, the greater activating effect will be used to give adequate control of the former, which are much more resistant to pyrethrins than *A. aegypti*. In the present tests, a dosage equivalent to 1·8 mg. pyrethrins in 27·8

ml. deodorised kerosene spray per 1,000 cu. ft. killed 87 per cent. of females of this species. The sesame oil alone in deodorised kerosene was practically non-toxic to *A. aegypti*; isobutylundecyleneamide similarly tested was slightly toxic. All the sprays containing pyrethrum gave a good knockdown, whereas those containing no pyrethrum gave a low knockdown or none.

GERSDORFF (W. A.) & GERTLER (S. I.). **Pyrethrum Synergists. Toxicity to Houseflies of certain N-substituted Piperonylamides and Benzamides combined with Pyrethrins in Oil Base Insect Sprays.**—*Soap* **20** no. 2 pp. 123, 125, 1 graph, 2 refs. New York, N.Y., 1944.

Certain N-substituted piperonylamides increase the toxicity of pyrethrum solutions used as sprays against *Musca domestica*, L. [*R.A.E.*, B **31** 210], and it has been found that N-substituted benzamides act similarly, though, unlike the former, they were not toxic when used alone at a concentration of 10 mg. per ml. The results are given of tests of the comparative effectiveness of N-isobutylpiperonylamide, N-butylpiperonylamide, N,N-diethylpiperonylamide, N-butylbenzamide and N,N-dibutylbenzamide. They were dissolved in acetone, and refined kerosene was added to form 90 per cent. of the total volume. Each solution also contained 0·5 mg. pyrethrins per ml., and solutions containing 1 and 2 mg. pyrethrins per ml. only were included for comparison. The tests were made by the turntable method [**26** 246]. All the flies were knocked down in 10 minutes in all tests. The concentrations of the five compounds required to give 50 per cent. mortality when combined with 0·5 mg. pyrethrins were 2·3, 2·0, 1·6, more than 30 and 16 mg. per ml., respectively, and that of pyrethrins alone was 2·4 mg. The superiority of N,N-diethylpiperonylamide over the other two piperonylamides was significant, but none of the three was significantly different in toxicity from the pyrethrins. At 4 mg. per ml., the three piperonylamides, when mixed with 0·5 mg. pyrethrins per ml., each gave a spray that caused a much higher mortality of *M. domestica* than 2 mg. pyrethrins, and at 2 mg. per ml., under the same conditions, they gave sprays equal to or better than the same concentration of pyrethrins.

NAPIER BAX (S.). **A practical Policy for Tsetse Reclamation and Field Experiment.**—*E. Afr. agric. J.* **9** nos. 1–3 pp. 2–13, 83–87, 157–162, 1 fldg. map, 4 pls., 8 refs. Nairobi, 1943–44.

The following is based on the author's summary. The species of *Glossina* present in Tanganyika, Uganda and Kenya are enumerated, notes are given on their vegetational requirements and the trypanosomes they carry, and the measures that can be undertaken to reclaim land from infestation by the different species are described, mainly on the basis of experience in Tanganyika. The present boundaries of cultivation steppe (an open area under sufficiently close human occupation to have been cleared of much of its natural woody vegetation) should be maintained by "defence lines," indicated by parallel plough furrows a thousand yards apart or by any other physical features, beyond which tsetse would not be allowed to advance. Dry thorn savannah infested by *G. swynnertoni*, Aust., has been reclaimed at Shinyanga by clearing the hardpan (narrow strips of non-cracking soil found along the drainage lines of much of the thorn-bush) of its easily felled vegetation at a cost of 1 man-day per $\frac{3}{4}$ acre without fire-exclusion, organised grass fires or thicket cutting. Treatment of 75,000 acres at Ukerewe by this method at a cost of 1 man-day per 2 acres has resulted in a very great reduction in the numbers of *G. swynnertoni* and in sleeping sickness. Thorn savannah and miombo (*Isoberlinia-Brachystegia*) wooding can be reclaimed from *G. pallidipes*, Aust., by removing the

thicket if it is not so extensive as to render the measure uneconomic. The reclamation at Mpwapwa on these lines is described. The great plains carrying a lace-work of vegetation of gall-acacia (*Acacia drepanolobium*), which *G. swynnertoni* and *G. morsitans*, Westw., visit but in which they cannot breed, can be reclaimed by isolating them from the surrounding thorn bush and cutting out patches of thorn bush within them. This has been done over 160,000 acres of plains infested with *G. swynnertoni* at Shinyanga at a cost of 1 man-day per 3 acres with an annual upkeep cost of 1 man-day per 80 acres. Similar operations in progress against *G. morsitans* and *G. swynnertoni* in the Kondoa district are described. A description is also given of a modification of the method by which it is proposed to reclaim plains in the Northern Province in which gall-acacia is replaced by other types of *Acacia* and the tsetse present is *G. swynnertoni*, with *G. pallidipes* on the thicketed rivers. The estimated amount of labour required is 1 man-day per 2 acres. Where *G. pallidipes*, *G. brevipalpis*, Newst., *G. austeni*, Newst., and *G. palpalis*, R.-D., live in linear communities along watercourses, large stretches of the surrounding country can be reclaimed from the first three species by reducing the source of infestation to an open parkland. At Kingolwira, the initial labour required was 25 man-days per acre. *G. palpalis* is nearly always confined to narrow strips along the lake shore and rivers flowing into the lakes. Organised settlement can do much to rid the country of it, and an alternative measure is block catching [*R.A.E.*, B **25** 165].

The problem of small isolated bush villages infected with *Trypanosoma rhodesiense* has been solved by concentrating the population into aggregations of at least 3,000–4,000 persons. Towns and township areas can be protected from incursions of tsetse, generally *G. morsitans*, *G. swynnertoni* and *G. pallidipes*, by the establishment of fly pickets on the roads. The tsetses within the towns, generally *G. pallidipes*, *G. brevipalpis* and *G. austeni*, can be dealt with by the destruction of the thickets. The plans worked out for the reclamation of the Dar es Salaam area, of 31,250 acres, are described. The initial cost would be about $3\frac{1}{2}$ man-days per acre. The problem of alienated land is discussed. When a large proportion is land under cultivation, the same methods can be applied as in township areas. Reclamation is more difficult in other circumstances, but it may be possible to apply one or other of the methods described. Co-operation is essential, and there must be legislation to enforce it on all owners when necessary. Reclamation by means of organised grass fires and the isolation of special vegetational areas is described, but these methods are not stressed as they necessitate the use of barrier clearings, which are expensive to maintain and ineffective unless very wide.

Suitable legislation is essential to deal with three aspects of the problem, *viz.*, the control of sleeping sickness by concentration of the population and subsidiary measures, the regulation of traffic, chiefly by putting road pickets on a legal basis, and finally the extermination of fly on private land.

It is concluded from this review that several thousand square miles of Tanganyika can be cheaply reclaimed with present knowledge, but that it is not yet possible to reclaim the great mass of the infested bush irrespective of its composition. Various field experiments that are in progress with a view to extending present powers but have been interrupted by the war are discussed. The effect of fire-exclusion and clearing of the hardpans on *G. swynnertoni* and *G. pallidipes* is being studied at Shinyanga. They are proving most promising against the former, and there is no evidence that fire-exclusion is causing the latter to increase as might have been expected. Fire-exclusion, carried out over a period of five years in Northern Rhodesia, did not suffice alone to destroy *G. morsitans* throughout the area, though it exterminated it in certain long-grass valleys and very much reduced it in other places. Remaining foci were found to be dependent on a certain type of narrow drainage valley ; clearing these valleys gave most promising results in conjunction with fire-exclusion, and even alone. Cutting the undergrowth and tangled creepers from 100 acres of the

common coastal thicket at Kilifi and placing a narrow barrier-clearing around the area reduced the incidence of *G. pallidipes* to 2·5 per hour, whereas outside the area in the general thicket it was 66.

Where the population is dense, man power should suffice for putting the methods discussed into operation. Where it is not, the modern caterpillar tractor can be used for clearing and making firebreaks. Natural boundaries to the fly-belts are described and discussed. The northern portion of Tanganyika is shown to possess at least 17 isolated or almost isolated infested blocks varying in size from 300 to 13,000 sq. miles, including protrusions into Kenya. Reclamation would start at one end of a block, with the flanks resting on tsetse-free country, and would be gradually pushed forward, over a period of years if necessary. There should then be no danger of reinfestation of the reclaimed block. The cheap methods of reclamation that have already been evolved are largely applicable to the economically important Lake and Northern Provinces. Survey would probably show that the hundreds of square miles known to be reclaimable in these areas could be increased to several thousand. The two great southern *G. morsitans* belts of Tanganyika are considered. The western one is isolated, but the one to the east extends for an unknown distance into Portuguese East Africa. The problem is compared with the one that is being successfully dealt with in Southern Rhodesia [**30** 8, 54, etc.], and the possibilities of reclaiming these belts are discussed, but a method of reclaiming the true habitat of *G. morsitans*, the miombo wooding, is at present lacking. The view that sheer clearing of the bush is the sole means of reclamation from tsetse is examined in detail and rejected.

To implement an anti-tsetse policy, a territorial committee, composed of all departments closely concerned, should lay down general principles and consider the large-scale reclamation schemes. Inter-territorial meetings should be held from time to time. Sub-committees are suggested for the Provinces to deal with local schemes. Reclamation should be in the hands of experts, closely associated with the research side of the work.

CHORLEY (T. W.). *Glossina palpalis fuscipes* **breeding away from Water (Diptera).** —*Proc. R. ent. Soc. Lond.* (A) **19** pt. 1–3 pp. 1–4, 4 refs. London, 1944.

W. F. Fiske, in a paper on the eastern form (*fuscipes*, Newst.) of *Glossina palpalis*, R.-D., in Uganda [*R.A.E.*, B **8** 131] gave several instances of its occurrence far from water, though he did not record it breeding more than 1,200 yards away. He concluded that it might exist in any locality remote from permanent water where favourable hosts occurred in well-sheltered areas provided with suitable breeding places. J. Schwetz found evidence of the breeding of *G. palpalis* 1,650 yards away from water in the Belgian Congo [**10** 99], and F. Zumpt indicated that it might breed at a distance from water [**25** 125]. C. F. M. Swynnerton [**25** 60] thought that the limiting factor was the localised habits of the animals on which it feeds.

Fiske's belief was substantiated in 1943 by the finding of breeding places of *G. palpalis fuscipes* several miles from water in 17 areas in Busoga District, Uganda, in dense, very humid forest, broken up by numerous elephant tracks, which provided mixed light and shade for the adult flies. In one instance, the nearest permanent water of any sort was four miles away. In the others, little attention was paid to small water holes, as it was desired to ascertain how far from Lake Victoria breeding was taking place. The maximum distance inland at which evidence of breeding was found was 12 miles. There was no water nearer than the lake in the dry season apart from the small water holes, and breeding places were never found around these. Pupae and empty puparia were numerous, and many larvae had evidently been deposited during the dry season. All the breeding sites were under fallen trees or at the base of standing ones. On three occasions, pupae of *G. palpalis* at

such a site were accompanied by those of *G. pallidipes*, Aust., and in one instance the latter species occurred alone. The food-supply available for the fly, which was plentiful, is discussed. Suitable conditions of shade and humidity rather than food-supply are thought to be the factors that normally limit *G. palpalis* to the neighbourhood of permanent water in Uganda.

BUSVINE (J. R.). **Simple Experiments on the Behaviour of Body Lice (Siphunculata).**—*Proc. R. ent. Soc. Lond.* (A) **19** pt. 1–3 pp. 22–26, 5 refs. London, 1944.

In each of the four experiments comprising the first group described, 12 body lice [*Pediculus humanus*, L.] were placed on the part of a fleecy woollen vest that would lie against the small of the back, the vest was worn with other clothing for two hours, during most of which time the host sat quietly, and the clothing was then removed and searched. Lice were found on the vest and pants in all experiments, often on the outer surface of the former, on the shirt in two and the pubic hair in three. Eggs had been laid on the pubic hair. When 12 lice were similarly released on a patch of vest 3 inches square contaminated by the excreta of 60 lice that had been confined on it for three days, one was recovered on the outside of the pants, two on the shirt, six on the vest and one on the pubic hair. Thus, the smell of the excreta, to which Wigglesworth [*R.A.E.*, B **29** 168] had shown lice to react favourably, had not been sufficiently attractive to inhibit wandering. The minimum distance that the lice had travelled to reach the points at which they were found was measured in every case. The longest distance from the point of release at which any were recovered was 25 inches. In similar experiments in which 10 nymphs and 10 adults were released on a pleated cotton belt to discourage wandering, it was found that when ½ hour's exercise in heavy clothing was taken to promote sweating, the lice wandered further than when the host sat quietly throughout the two hours, and in all cases the adults wandered much further than the nymphs. When a man slept in a cotton sleeping bag containing 16–20 lice, 40 and 50 per cent. of the lice were found on the pyjamas in the morning in the two cases when these were of flannel and 10 and 15 per cent. when they were of poplin. The percentages found on the body and inside and outside the bag and not recovered were 0-6, 6-45, 13–40 and 0–25. The lice that escaped from the bag travelled a minimum distance of 6 ft., and such migration may explain the rapid disappearance of infestation observed in casual beds [**30** 20].

Tests were also made of the efficiency of a louse-proof gown designed to protect persons engaged in typhus work [*cf.* **30** 180] ; it gives complete protection except for the opening at the back and those round the face and wrists. The one used had a double edging of gauze containing a cotton-wool pad round the face, and the edges of the back opening were extended to form a flap that was rolled up and tied across with tapes. Lice were placed near the face opening and back flap and looked for after an hour ; at this time, several were found to have reached the inside of the gown in each of two tests. However, when the gauze and the edges of the back flap were sprayed with 2–4 cc. undiluted Lethane 384 [butyl carbitol thiocyanate at a concentration of 50 per cent. in refined kerosene], no lice reached the inside in any of four tests. As the Lethane is removed by laundering or steam sterilisation, a fresh application should be made every day before the garment is put on. The inside of the gauze must not be sprayed, as stinging of the face may result.

RILEY (W. A.). **Introduction to the Study of Animal Parasites and Parasitism.**—$10\frac{3}{4} \times 8\frac{1}{2}$ ins., iii+87 pp. multigraph, 1 pl., 14 pp. refs. Minneapolis, Minn., Burgess Publ. Co., 1943. Price $1·50.

This work is designed primarily as a guide for students, supplemented by a comprehensive bibliography, rather than as a text-book and deals with the

subject mainly from the biological point of view, with examples chiefly drawn from the field of human parasitology. Morphological and biological adaptation to the parasitic habit, host-parasite specificity, the reproduction of parasites, sources of infection, the channels of entry into the host, the action of parasites on their hosts and the reaction of the latter, the determination of parasites in the living host and control are among the subjects very briefly dealt with in the general introductory section.

The main part consists of a review of the parasitic Protozoa, organisms of uncertain affinities, such as spirochaetes and rickettsiae, Platyhelminths, Nemathelminths, Hirudinea and Arthropoda.

The section on Arthropods is largely based on the monograph on Medical Entomology published by the author and O. A. Johannsen in 1938 [*R.A.E.*, B **20** 112; **27** 40]. Three groups of noxious Arthropods are defined: those that are poisonous, those that are parasitic and those that transmit or disseminate disease. Five classes of Arthropods are then briefly characterised and discussed in turn. The characters of the orders of Arachnids and insects concerned with human or animal health are also shown, together with those of certain families and some species of outstanding importance. Notes are given on the injuries or diseases they cause or carry, and sometimes on their hosts, distribution, life history or control and on other points of interest.

Biological Control Activities.—*Rep. P.R.* [*fed.*] *Exp. Sta. 1940* pp. 65–71. Washington, D.C., 1941. [Recd. 1944.]

This report on work in Porto Rico in 1940 includes a record of the despatch on 22nd May of 500 adults of *Spalangia philippinensis*, Fullaway, to Colombia for the control of *Lyperosia* (*Haematobia*) *irritans*, L., on cattle. All but three of the parasites arrived alive. The stock was reared from adults obtained from puparia of *L. irritans* collected in localities where *S. philippinensis* had previously been liberated [*R.A.E.*, B **27** 190].

Entomology.—*Rep. Waite agric. Res. Inst. S. Aust. 1941–42* pp. 30–36. Adelaide, 1943.

Observations made in 1942 showed that the Australian bush fly (*Musca vetustissima*, Wlk.) breeds freely in cow dung from November to May in the district of Adelaide in South Australia, but brief tours in the northern pastoral country provided no evidence of where it breeds in the arid bush areas. Adults caught in nature could be kept alive in cages for up to 80 days on a diet of honey and water. Eggs were laid on cow dung by females fed from emergence on this diet, but only six out of 326 gave rise to adults. Adults emerged from 30 out of 32 puparia kept at 30°C. [86°F.] and from 101 out of 120 kept at 18°C. [64·4°F.], with dry atmospheres in both cases.

Taylor (F. H.). **Intermediary Arthropod Hosts and mechanical Carriers of Human Disease in the Australian Region.**—*Health* August 1938 repr. 5 pp., 1 map. Melbourne, 1938. [Recd. 1944.]

A list is given of the Arthropods that act as intermediate hosts, mechanical carriers or causes of diseases of man in the Australian region (Australia, New Zealand, New Guinea, the Moluccas and the Pacific Islands south of the equator and as far east as 140°W.), showing the disease, diseases or condition concerned in each case, the mannner in which the Arthropod transmits or causes them, and its normal host, breeding habits and distribution within the region.

Pirot (R.) & Bourgain (M.). **Echec de la transmission expérimentale du typhus murin par broyat et déjections d'***Ornithodorus erraticus*.—*Bull. Soc. Path. exot.* **36** no. 11–12 pp. 326–330. Paris, 1943.

As *Ornithodoros erraticus*, Lucas, is found in pig farms and also habitually in the burrows of small rodents and its distribution includes regions where epidemic typhus occurs and others, particularly Morocco, where murine typhus is endemic, it was thought desirable to determine whether it could acquire and harbour the causal organism of murine typhus from wild rodents and transmit it through its excreta. Batches of 14–25 last-stage nymphs were allowed to engorge on infected guineapigs on the first, second or fourth days of fever, respectively. Suspensions of some of them were prepared and inoculated into susceptible guineapigs immediately after the meal and after 7, 33 and 63 days, but the guineapigs did not become infected. Others were transferred to clean containers when the emission of coxal fluid after the feed had ceased, the excreta were collected on filter paper 10 or 155 days later and a solution of them was inoculated into guineapigs. The two guineapigs inoculated with excreta collected after ten days showed a slight irregular thermal reaction, but the causal organism was not present in sufficient quantity to produce apparent infection.

Mazza (S.). **Comprobación de** *Eutriatoma oswaldoi* **(Neiva y Pinto, 1923) Pinto, 1931, y** *Eutriatoma sordida* **(Stål, 1859) Pinto, 1931, en la Republica del Paraguay.** [*Triatoma oswaldoi* and *T. sordida* recorded from Paraguay.]—*Prensa méd. argent.* **30** no. 48 repr. 8 pp., 15 refs. Buenos Aires, 1943.

Until recently, the only Triatomids known from Paraguay were *Triatoma infestans*, Klug, *Panstrongylus geniculatus*, Latr., and *P. megistus*, Burm., but a collection of bugs taken in a house in April 1943 comprised three adults of *T.* (*Eutriatoma*) *oswaldoi*, Neiva & Pinto, as well as five of *T. infestans*. One of the latter was alive and was found to be negative for *Trypanosoma* (*Schizotrypanum*) *cruzi*; the other bugs were dead and too desiccated to be examined. Records are given of the finding of *Triatoma oswaldoi* with and without infection by *Trypanosoma cruzi* in many parts of Argentina; it is also known to occur in Brazil, Peru, and Bolivia. Three examples of *Triatoma* (*E.*) *sordida*, Stål, stated to have been collected in Paraguay, were identified in a collection in 1940. Additional distribution records are given for this species in Argentina [*cf. R.A.E.*, B **26** 177; **32** 57] and Bolivia [*cf.* **32** 13]. In 1938, 50 per cent. infection of *T. infestans* by *Trypanosoma cruzi* was recorded in adults and nymphs from three forts in Paraguay. The proved cases of Chagas' disease in the country are reviewed. The first was diagnosed in 1939.

Papers noticed by Title only.

Sicart (M.). **Contribution à l'étude des anophèles de Tunisie. Présence de** *Anopheles* (*A.*) *marteri* **(Senevet et Prunelle 1927).**—*Arch. Inst. Pasteur Tunis* **31** no. 1–2 pp. 132–134, 1 fig., 4 refs. Tunis, 1942. [Recd. 1944.]

Roubaud (E.) & Grenier (P.). **Simulies de l'ouest africain (Afrique équatoriale et occidentale françaises)** [including four new species].—*Bull. Soc. Path. exot.* **36** no. 9–10 pp. 281–311, 10 pls., 11 figs., 23 refs. Paris, 1943.

Roth (L. M.). **A Key to the** *Culex* **(Diptera, Culicidae) of the southeastern United States, by Male Terminalia.**—*J. Kans. ent. Soc.* **16** no. 4 pp. 117–133, 34 figs., 8 refs. Manhattan, Kans., 1943.

GLASS (E. H.). **Value and Use of volatile Nitriles for Household Fumigation.**—*J. econ. Ent.* **37** no. 1. pp. 74–78, 4 refs. Menasha, Wis., 1944.

Previous work on the toxicity of nitriles is reviewed, and an account is given of tests of trichloracetonitrile as a household fumigant alone and mixed with an equal quantity of acrylonitrile. Both are colourless liquids, volatile at room temperature, very toxic to insects but not highly dangerous to warm-blooded animals. The former is a lacrymator at concentrations not immediately dangerous and is not inflammable. Acrylonitrile is inflammable between the limits of 3 and 17 per cent. by volume in air and has no warning properties. Comparative tests of various conditions were made in a constant temperature fumigation chamber with a capacity of 740 cu. ft. furnished as a bed-room. For each test, five glazed, unperforated pill boxes containing 10 last-instar nymphs or adults of the bed-bug [*Cimex lectularius*, L.], five containing 10 adults of the confused flour beetle [*Tribolium confusum*, Duv.] and five containing 4–5 larvae of the black carpet beetle [*Attagenus piceus*, Ol.] were distributed about the chamber. For application, the desired quantity of liquid was poured into a jar containing absorbent pellets, which were later spread upon gauze suspended about a foot from the ceiling. A dosage of 1 lb. per 1,000 cu. ft. was used in all tests. Both trichloracetonitrile and the mixture were more effective at 75–85 than 55–60°F. Temperature did not affect the period of airing necessary after fumigation, but moist conditions (relative humidity almost 100 per cent.) prolonged it by several hours. Moisture did not influence effectiveness. The length of exposure did not influence the period necessary for airing, but exposure for 12 hours was consistently more effective than exposure for 6. With 12 hours' exposure, both trichloracetonitrile and the mixture gave 100 per cent. mortality of all insects at the higher temperatures and of all except the larvae of *Attagenus* at the lower ones ; trichloracetonitrile gave 100 per cent. mortality of *Cimex* and *Tribolium* in 6 hours at the higher temperatures. An increase in the moisture content of furnishings within a day or two after the fumigation caused eye irritation after all effect on the eyes had ceased under dry conditions.

The results of seven practical fumigations in which the pellets were spread on a gauze tray on a six-foot tripod, indicated that a dosage of 2 lb. trichloracetonitrile per 1,000 cu. ft. for 6 hours or 1·5 lb. for 12 hours should be adequate in a tightly closed building. Slightly higher concentrations or longer exposures may be necessary when the mixture is used, particularly if the larvae of clothes moths or carpet beetles are present. Aeration was so rapid that it was possible to fumigate a house during the day, ventilate it for a few hours and allow the occupants to return the same night. Operators should wear gas masks while charging and distributing the pellets and when entering a house under fumigation. In houses being opened for ventilation, exposure to the vapour of trichloracetonitrile for 10–15 minutes resulted in a burning sensation in the scrotum, but this can be avoided by leaving the house after about 5 minutes and returning to complete the task a little later. Contact of both liquids with the skin caused a transitory tingling sensation without subsequent injury. The methods of testing for the presence of gas after airing are described.

SMITH (C. N.) & GOUCK (H. K.). **Sprays for the Control of Ticks about Houses or Camps.**—*J. econ. Ent.* **37** no. 1 pp. 85–87, 1 ref. Menasha, Wis., 1944.

The following is mainly based on the authors' introduction and summary. Ticks of the group known in the United States as wood ticks commonly infest extensive areas of bush country in which their complete control is impracticable. It is sometimes important, however, to reduce their numbers in a small part of a large infested area, such as the immediate neighbourhood of a military camp, and sprays may be of value for this purpose. A spray of 1 part nicotine sulphate and 1 part soap in 288 parts water reduced the abundance of active *Dermacentor*

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variabilis, Say, on vegetation by about 90 per cent. for 2–3 days [*cf. R.A.E.*, B **29** 137] and was not injurious to the vegetation, but many of the ticks recovered. This spray, with the content of nicotine sulphate increased to 1 : 200, is recommended where only temporary protection is required. A spray containing 1·5 per cent. sodium fluoride, 0·5 per cent. nicotine sulphate and a little neutral soap gave quick knockdown and high kill of adults of *D. variabilis*, adults of *Ixodes scapularis*, Say, and nymphs and adults of *Amblyomma americanum*, L., when applied at 73, 102 and 174 U.S. gals. per acre, respectively, but was injurious to foliage. It is recommended for use where there are no valuable plants and when more lasting reductions in the populations of the ticks are desired. It was not effective against the chigger mite, *Trombicula* (*Acariscus*) *masoni*, Ewing. One of two proprietary preparations of dinitro-ortho-cyclohexylphenol was almost as effective against *D. variabilis* as sodium fluoride, but it also required the addition of nicotine sulphate for quick effectiveness and was equally injurious to foliage. A spray containing 2·6 ml. purified pyrethrum extract (20 per cent. pyrethrins) in 1 U.S. gal. water with 1 ml. isobutylundecyleneamide as an activator and 0·125 oz. soap was as effective as the spray of sodium fluoride and nicotine sulphate against nymphs and adults of *A. americanum* and even greater dilutions were effective against adults of *I. scapularis*. With each of the last three materials, an immediate reduction in tick abundance of more than 90 per cent. was obtained. The rapidity of reinfestation varied with the numbers of ticks hatching, emerging from hibernation, moulting and migrating from untreated areas. In most cases, the reduction was at least 75 per cent. for a week, probably the interval that would be allowed between applications in practice. Sprays containing emulsions of pine oil and diphenylamine in benzene were not satisfactory against adults of *D. variabilis* in field tests.

MIDDLEKAUFF (W. W.) & CARPENTER (S. J.). **New Distribution Records for the Mosquitoes of the southeastern United States in 1943.**—*J. econ. Ent.* **37** no. 1 pp. 88–92, 2 refs. Menasha, Wis., 1944.

WANAMAKER (J. F.), CHAMBERLAIN (R. W.) & CARPENTER (S. J.). **Distribution of *Culex pipiens* in the southeastern United States.**—*T. c.* pp. 106–107, 1 map, 3 refs.

CARPENTER (S. J.) & MIDDLEKAUFF (W. W.). **Inland Records of Salt Marsh Mosquitoes.**—*T. c.* p. 108, 1 map, 3 refs.

BRADLEY (G. H.), FRITZ (R. F.) & PERRY (L. E.). **Additional Mosquito Records for the southeastern States.**—*T. c.* p. 109, 2 refs.

It is recorded in the first paper that from the beginning of 1943 until the end of October, 540,748 adults and 151,891 larvae of mosquitos from the south-eastern United States, excluding Louisiana and Arkansas [*cf. R.A.E.*, B **28** 31], were identified at the Fourth Service Command Medical Laboratory. A check list is given of the mosquitos of this area, including previous records [**31** 232 ; **32** 77], those of the present survey and one record made by J. N. Belkin. A list is also given of the specific records made during the survey, showing the place and method of collection, the number of individuals taken, their sex if adult, the date of capture and new State records. A similar list of mosquitos taken in the south-eastern United States, including Arkansas and Louisiana, chiefly in 1942 by field workers of the Office of Malaria Control in War Areas of the United States Public Health Service, is given in the fourth paper. In both papers, *Anopheles crucians bradleyi*, King, and *A. walkeri*, Theo., are recorded from North Carolina, where they were not previously known to occur, and *A. atropos*, D. & K., is recorded for the first time from Georgia in the former and *A. walkeri* from South Carolina in the latter.

In the second paper, it is pointed out that the ranges of *Culex pipiens*, L., and *C. fatigans*, Wied. (*quinquefasciatus*, auct.) overlap in a transitional zone

of varying depth, including all or parts of North Carolina, Tennessee, Virginia, Kentucky and southern West Virginia, and that considerable confusion regarding the limits of their distribution has arisen from the fact that they cannot be distinguished except by examination of the male genitalia. The range of *C. pipiens* was found in 1942 [**32** 77] to include parts of Georgia, South Carolina and Alabama. In this paper are recorded the numbers of males of *C. pipiens* and *C. fatigans* determined by examination of the genitalia in catches made in 1943 at posts in the Fourth Service Command where the former was found. The presence of *C. pipiens* in northern Mississippi was established. On the basis of the two years' records, its probable southern limit is shown on a map.

The third paper deals with the occurrence inland of the salt-marsh mosquitos, *Anopheles atropos*, *Aëdes sollicitans*, Wlk., and *A. taeniorhynchus*, Wied., in the south-eastern United States. Both the species of *Aëdes* fly long distances, but individuals found inland may have been carried there on vehicles. Instances are cited from the literature of inland breeding by these two species, and records of the capture of adults of both in 1942 and 1943 and of a few of *Anopheles atropos* in 1943 are given in lists and also shown on a map.

LATTA (R.). **Methyl Bromide Fumigation for the delousing of Troops.**—*J. econ. Ent.* **37** no. 1 p. 103. Menasha, Wis., 1944.

The gas-tight bags that are being extensively used in the United States Army for freeing the clothing of the troops from lice [*Pediculus humanus*, L.] by fumigation with methyl bromide are briefly described [*R.A.E.*, B **32** 20]. The period of exposure in the bags is 45 minutes, and the clothing may be put on as soon as it has been shaken. Details are given of the procedure followed in the use of vaults or cabinets for operations on a larger scale. The clothing and equipment are fumigated while the men proceed through showers, undergo medical examination and are sprayed with an anti-louse spray containing an ovicide. The cabinets are operated in batteries of 3–6, loaded in rotation. By this method, 150–450 men per hour can be dealt with.

CHRISTENSEN (G. R.) & HARMSTON (F. C.). **A preliminary List of the Mosquitoes of Indiana.**—*J. econ. Ent.* **37** no. 1 pp. 110–111. Menasha, Wis., 1944.

A list is given of mosquitos taken in Indiana in 1941–1942, showing their prevalence and the places and dates of capture. The Anophelines found were *Anopheles barberi*, Coq., *A. crucians*, Wied., *A. punctipennis*, Say, *A. quadrimaculatus*, Say, and *A. walkeri*, Theo.

THURMAN jr. (D. C.). **The Biology of *Triatoma neotomae* Neiva in Texas.**—*J. econ. Ent.* **37** no. 1 pp. 116–117, 5 refs. Menasha, Wis., 1944.

Reference is made to early records of *Triatoma neotomae*, Neiva, in Texas, where it was again taken in 1942 and 1943, in nests of *Neotoma*. In some cases nymphs were found in nests containing ticks (*Ornithodoros talaje*, Guér.) infected with the relapsing-fever spirochaetes. T. de Shazo has recorded that faeces of individuals of *T. neotomae* from Texas harboured *Trypanosoma cruzi*. An adult female collected on 23rd September, 1942, laid 11 eggs on 25th and 2 on 27th, which hatched on 16th and 18th October, respectively. The nymphs were allowed to feed on rabbits at intervals of 5 days, and the first moults occurred on 5th November. They were fed at weekly intervals throughout the winter and spring. Moults into the fifth instar occurred in June and July. The first adult, a male, emerged on 22nd October, when the last fourth-instar nymph moulted to the fifth instar. Only two nymphs died during the period of study. A fifth-instar nymph weighed and fed immediately after moulting showed a 133·68 per cent. increase over the unfed weight and an adult male showed an increase of

41·28 per cent. The respective weights of the unfed nymph and adult were 49·0 and 80·85 mg. Hungry bugs readily took blood from rats, guineapigs, rabbits and man.

KNOWLTON (G. F.) & MADDOCK (D. R.). **Snipe Flies in Utah.**—*J. econ. Ent.* **37** no. 1 p. 119. Menasha, Wis., 1944.

An account is given of the finding of large numbers of *Symphoromyia hirta*, Johnson, at an elevation of about 9,600 ft. in a national forest on the Wasatch Mountain range in Utah on 24th July 1943. About 350 were resting on a cast-iron water hydrant, 2 ft. high, standing in a sunny, cleared place, while some 2,000 or more swarmed around it in a column about 3 ft. in diameter. They attacked viciously anyone who approached and were still so abundant after about half a pint had been taken in one minute's collecting with nets that the two collectors had to enter a closed car for protection. At a neighbouring hydrant in a partly shaded position, the flies were numerous, but not comparably so. There was a rock base and wet area round each hydrant. About 15 minutes after the catch was made at the first hydrant, the remaining flies had been joined by others and there were about 60 per cent. as many as at first. *S. atripes*, Bigot, was fairly abundant and attacking readily in the area, but was not observed to join in the swarming. This species was more plentiful at lower elevations, but *S. hirta* decreased in abundance at lower elevations towards the east and south-west. Records are given of its capture at different times in various parts of Utah, where it is often abundant, particularly during July and the first half of August.

Simuliids were seen swarming around the heads of horses in the same part of the State on 24th August 1943, 15–35 were present in each ear examined, and there were dozens of feeding females on the bodies of the animals, many gorged with blood. Of 83 individuals identified, 77 were *Simulium arcticum*, Mall., and 6 *S. vittatum*, Zett. In addition, 15–25 snipe flies, about 90 per cent. of them *Symphoromyia hirta* and the rest *S. atripes*, were attacking each horse.

GINSBURG (J. M.). **Toxicity of DDT to *Blattella germanica*, as compared with Sodium Fluoride, Derris and Pyrethrum.**—*J. econ. Ent.* **37** no. 1 p. 122. Menasha, Wis., 1944.

Laboratory tests were carried out during the summer of 1943 on the comparative toxicity to *Blattella germanica*, L., of 2, 2-bis (parachlorphenyl)-1, 1, 1-trichlorethane (the compound known as DDT), sodium fluoride, and finely ground powders of derris root containing 5 per cent. rotenone and pyrethrum flowers containing about 1 per cent. pyrethrins. They were tested as dusts in a base composed of equal parts of talc and soy-bean flour. The dusts were applied to the insides of large glass jars, and the excess was shaken out leaving a deposit of about 0·8 mg per sq. in. over the bottom and inner walls. Adults of *B. germanica*, 10 weeks old, were then transferred to the jars and kept under observation, supplied with water, for 48 hours. The minimum concentrations of DDT and sodium fluoride required to give complete kill in this time were 7 and 33 per cent. respectively [*cf. R.A.E.*, B **32** 156], while 33 per cent. derris and pyrethrum gave, respectively, 30 and 90 per cent. kill.

ANNAND (P. N.) & others. **Tests conducted by the Bureau of Entomology and Plant Quarantine to appraise the Usefulness of DDT as an Insecticide.**—*J. econ. Ent.* **37** no. 1 pp. 125–159. Menasha, Wis., 1944.

The papers in this symposium are by the chief and members of the staff of the U.S. Bureau of Entomology and Plant Quarantine, and the following are abstracts of the introductory discussion and of those that deal with tests against Arthropods of medical or veterinary importance [*cf. R.A.E.*, A **32** 376–387].

Annand (P. N.). **Introductory Discussion of DDT,** pp. 125–126, 11 refs. One of the more promising proprietary materials tested during recent months as substitutes for insecticides that are no longer available is the synthetic organic compound 2, 2-bis (parachlorphenyl)-1, 1, 1-trichlorethane, which, when chemically pure, is a crystalline solid, practically colourless, almost odourless and rather stable, insoluble in water, but soluble in most organic solvents and of low volatility. Formerly a technical grade manufactured in Switzerland was referred to as GNB, and one manufactured in the United States as GNB–A, but the designation DDT, derived from the alternative name dichlor-diphenyl-trichlorethane, has now been adopted. Preparations of the compound are marketed in Switzerland as Gesarol spray insecticide (containing 5 per cent. DDT in a diluent with a wetting agent and an adhesive) and Gesarol dust insecticide (3 per cent. DDT) for agricultural uses, and as Neocid (5 per cent. DDT) for use against lice on man. DDT acts as a nerve poison to insects [*R.A.E.*, B **32** 179] and primarily as a nerve poison to higher animals ; it is distinctly toxic when ingested or dissolved in a solvent, such as oil, and absorbed through the skin. Preliminary data suggest, however, that it will probably be as safe to use against certain pests as some of the insecticides now employed. The loss of DDT by evaporation from spray deposits occurs too slowly to decrease its effectiveness appreciably.

Bushland (R. C.), McAlister jr. (L. C.), Eddy (G. W.) & Jones (H. A.). **DDT for the Control of Human Lice,** pp. 126–127. Tests in which the DDT powder recommended to the armed forces for the control of *Pediculus humanus humanus*, L. (*P. h. corporis*, Deg.) [**32** 39] was dusted on the inner surface of cloth sleeves infested with young adult lice and placed on the arms and legs, and others in which grossly infested men wore suits of treated underwear day and night under camp conditions indicated that it is highly effective and remains so longer than any other known treatment. Powder containing the approved percentage will apparently give complete protection for 3 weeks and effective control for longer. DDT does not kill eggs, but remains toxic for longer than the incubation period. It was equally effective in any one of a number of diluents. Applied as a powder, it also destroyed *P. humanus capitis*, Deg. (*P. h. humanus*, auct.) and *Phthirus pubis*, L. DDT, like some other materials, is effective against lice for a longer time when garments are impregnated with it than when it is used as a powder. Underwear impregnated with an unspecified concentration killed lice on grossly infested subjects for 3–5 weeks when not washed and for 2–3 weeks when washed weekly. Impregnation was accomplished equally effectively by dipping the garments in solutions of DDT in a volatile solvent or an aqueous emulsion. When the percentage of DDT was considerably increased, the garments gave complete control after 9 weeks' wear and 9 washings. An intermediate strength, which remains effective through 6–8 washings, has been recommended to the forces. Various liquid preparations of DDT, including solutions and emulsions, have been tested for application as sprays or otherwise, and the lowest concentration that will destroy the three kinds of lice and provide residual action when applied as a spray over the whole body has been recommended for use by the forces. DDT is particularly useful in liquid form for the control of *Pediculus h. capitis* and *Phthirus pubis*.

Madden (A. H.), Lindquist (A. W.) & Knipling (E. F.). **DDT as a residual Spray for the Control of Bedbugs,** pp. 127–128. As many bed-bugs remain concealed and protected when sprays are being applied, the degree of control obtained depends largely on the toxicity of the deposit left on the surfaces with which the bugs come in contact when they leave their hiding places. The residue should retain its toxicity long enough to prevent early reinfestation as a result of the hatching of eggs or the introduction of additional bugs. An investigation to find a suitable material was begun in Florida in 1942. Some 1,500 laboratory tests with about 100 materials were completed, and DDT, first tested in January 1943, was found to be outstanding, with pyrethrum

somewhat less effective. The results of laboratory and practical tests with DDT are given here, and a few results with pyrethrum are included for comparison. *Cimex lectularius*, L., and *C. hemipterus*, F., were used; no difference in resistance between them was detected. In the initial tests, woollen pads were sprayed or dusted on both sides with the test material, 0·25 ml. liquid or 0·08 gm. powder being used per pad, and five adult bedbugs were exposed to a treated pad in a jar with a capacity of 8 fl. oz. for 15 minutes. The pad covered the bottom of the jar. Fresh bugs were exposed to treated pads as long as complete mortality was obtained. Under these conditions, 5 per cent. DDT in a mixture of dimethyl phthalate and acetone and 1 per cent. DDT in deodorised kerosene gave complete kill for up to 39 days. A dust containing 0·3 per cent. pyrethrins and an activator in pyrophyllite gave complete kill for 2 days and partial kill for up to 49 days, and a dust containing 5 per cent. DDT in various diluents gave complete kill for up to 49 days and 87 per cent. mortality after 56 days.

Further tests were made in cages with glass sides and unpainted plywood tops and bottoms, each containing a miniature mattress and detachable unpainted wooden walls extending halfway up the inner sides. Fresh bed-bugs were introduced weekly after spraying and exposed for 48 hours. A spray of 20 per cent. DDT in orthodichlorbenzene applied at the rate of 100 mg. per sq. ft. to the mattress and lower half of the cage gave complete mortality 73 days after treatment [*cf.* **32** 40]. Orthodichlorbenzene alone gives no residual kill. In a cage that received the same treatment but was scrubbed with hot water and soap 8 days later, complete mortality was obtained 78 days after treatment. A spray containing 0·5 per cent. pyrethrins and 2 per cent. N-isobutylundecyleneamide in deodorised kerosene applied at the rate of 2·5 mg. pyrethrins per sq. ft. gave kills of 60–80 per cent. up to 22 days after treatment and after that time was practically worthless.

Practical tests in infested houses have been begun, and most of them are still in progress. Sprays are applied to a bedstead, springs, and mattress and to the floor and walls near the bed. The treated beds are subject to normal reinfestation, and fresh bugs are introduced weekly and recovered 48 hours later. Sprays of 140 ml. of 20 per cent. DDT and 40 per cent. orthodichlorbenzene in deodorised kerosene, 195 and 250 ml. of 5 per cent. DDT in kerosene, 250 ml. of 5 per cent. DDT in aqueous emulsion, and 250 ml. of 10 per cent. DDT and 5 per cent. cyclohexanone in kerosene have given complete mortality, 281, 64, 84, 133 and 104 days after treatment, respectively, but the full duration of effectiveness of the 5 per cent. sprays may not yet have been ascertained. In several small tests in barracks in Florida, 5 per cent. DDT in kerosene has been effective for several months. In a practical test still in progress in central Florida involving about 80 barracks, some of them heavily infested, the same solution has given complete control for four months. It is concluded that for practical use, particularly under military conditions, kerosene is the most satisfactory solvent and 5 per cent. the best concentration of DDT. The solution should be applied as a coarse spray, and at least 100 mg. DDT should be applied per sq. ft.

Lindquist (A. W.), Knipling (E. F.), Jones (H. A.) & Madden (A. H.). **Mortality of Bedbugs on Rabbits given oral Dosages of DDT and Pyrethrum,** p. 128. Lots of 12–15 adults of *Cimex lectularius*, L., and *C. hemipterus*, F., that had been reared on normal rabbits were allowed to feed through gauze for 5 minutes at intervals of about 1½–3 hours on rabbits that had received oral doses of 228–537 mg. DDT per kg. bodyweight. Tests were usually discontinued after 7–8 hours, but a few were made after 10, 12 and 24 hours. Complete mortality sometimes occurred when the bugs fed 3–5 hours after DDT had been administered at 228–400 mg. or 7–8 hours after it had been administered at 537 mg., and 44 and 80 per cent. mortality when they fed 24 hours after its administration at 228 and 537 mg., respectively. Some dosages had a toxic effect on the rabbits.

Pyrethrum extract at 250–400 mg. pyrethrins per kg. gave similar results but knock-down was faster, paralysis setting in in some cases during the 5 minutes of feeding. Mortality was complete in some cases among bugs fed after 1½–12 hours but there was none in a single test after 24 hours. Stable flies [*Stomoxys calcitrans*, L.] that fed on a few of the rabbits showed typical pyrethrum paralysis in less than a minute. Pyrethrum at these dosages did not appear to injure the rabbits. The addition of N-isobutylundecyleneamide, which is known to have a synergistic action on pyrethrum, did not increase the kill of the bed-bugs.

Smith (C. N.) & Gouck (H. K.). **Effectiveness of DDT in the Control of Ticks on Vegetation,** pp. 128–130, 1 ref. As several materials that controlled ticks on vegetation when used as sprays had serious drawbacks [**32** 193], experiments were made on the suitability of DDT for this purpose. Preliminary tests of solvents for it showed kerosene, mineral oil and castor oil to be inferior to benzene, pine oil and xylene. Each of the last three solvents was tested in combination with four emulsifiers, and each combination was tested with three strengths of DDT (0·2, 0·1 and 0·05 per cent.) against *Amblyomma americanum*, L., and with two strengths (0·02 and 0·01 per cent.) against *Ixodes scapularis*, Say. Ten adults of *A. americanum* were dipped in each of the 36 mixtures, and 20 of *I. scapularis* in each of the 24 mixtures; both series were repeated once. The percentages of ticks of each species active after one day and alive after six days are shown for each solvent and each emulsifier, the results with the different concentrations of DDT being averaged. In each instance, survival was lowest when pine oil (standard grade, destructively distilled) was the solvent and Areskap 50 (sodium monosulphonate of monobutyldiphenyl) the emulsifier, the percentages of the two species active after one day being 10 and 0, respectively, and the percentages alive after 6 days, 3 and 0. Pine oil and B-1956 (a phthalic glyceryl alkyd resin) gave almost equally good results, but all other combinations were distinctly inferior.

Field tests on DDT for the control of adults of *I. scapularis* were carried out with sprays and dusts. The dusts were prepared by dissolving DDT in acetone and adding the solution to pyrophyllite. The sprays contained a solution of DDT in pine oil (1 : 5) emulsified in water with Areskap 50 or B-1956. The treated areas were strips of roadside 484–1,362 ft. in length. Collections were made with a drag and all ticks returned to the vegetation as collected. The number of ticks collected before treatment and the percentages of the original infestation found 1, 2, 3–4, 5–6, 10–11 and 21–22 days afterwards are compared with corresponding figures for areas dusted with derris or sprayed with a mixture of nicotine sulphate and sodium fluoride and untreated areas. For the first 10–11 days after treatment, sprays containing 0·1 per cent. DDT applied at 1·3 U.S. gals. per 100 ft. of road were at least as effective as the nicotine sulphate and sodium fluoride at 1 U.S. gal., and the dusts containing 1 and 0·5 per cent. DDT at 7 and 7·7 oz., respectively, were as effective as the derris dust at 7·7 oz. or the sprays. Dust containing 0·1 per cent. DDT was less effective. Three weeks after treatment, the numbers of ticks recovered from the strips treated with the spray and dust containing, respectively, 0·1 and 1 per cent. DDT and with the spray of nicotine sulphate and sodium fluoride represented 1, 29 and 48 per cent., respectively, of the initial numbers.

Gouck (H. K.) & Smith (C. N.). **DDT in the Control of Ticks on Dogs,** p. 130. Emulsions prepared by dissolving 5 parts DDT in 6¼ parts benzene, adding 1¼ parts of any one of three commercial emulsifiers and pouring this slowly into 37½ parts rapidly stirred water gave complete kill of *Rhipicephalus sanguineus*, Latr., when long- or short-haired dogs were washed with them. In one test, all the engorged or partly engorged ticks, which numbered more than 1,000, had dropped at the end of ten days and were dead or died within 48 hours, but several hundred dead flat ticks were still attached. In the other tests, all ticks were dead after three days. When a heavily infested, long-haired dog was

washed in an emulsion containing only 2 per cent. DDT, a few ticks were still alive at the end of five days, some having dropped off alive and fully engorged. A dust of 10 per cent. DDT in pyrophyllite failed to give complete control of nymphs or adult females on a heavily infested cocker spaniel, and surviving females oviposited.

In experiments against *Amblyomma americanum*, L., no live ticks were found at any time on a short-haired dog, previously heavily infested with larvae, after it had been washed with an emulsion containing 5 per cent. DDT. All the ticks had been dislodged by the seventh day. When about 30 cc. of a solution of 20 per cent. DDT in benzyl benzoate was applied by means of an atomiser to a collie that was then allowed to run in an infested area, the treatment was not satisfactory. All the ticks that attached themselves completed engorgement, although many died after dropping. Only 46 of the 105 nymphs and 3,027 of the 6,707 larvae that completed engorgement lived to moult. In both these tests, a control dog was heavily infested with ticks that engorged normally. None of the dogs treated with DDT showed any ill effects.

Smith (C. N.) & Gouck (H. K.). **DDT, Sulfur, and other Insecticides for the Control of Chiggers,** pp. 131–132. An account is given of tests of dusts against *Trombicula* (*Eutrombicula*) *alfreddugèsi*, Oudm., in Georgia and *T.* (*Acariscus*) *masoni*, Ewing, in South Carolina in the summer of 1943. *T. alfreddugèsi* was abundant about the bases of living trees, but scarce 5–6 ft. away. *T. masoni* was most plentiful near decaying wood or in open spaces covered with dead leaves. The materials that gave the best control of *T. masoni* were sulphur, dinitro-o-cresol and DDT. Elemental sulphur appeared to be slightly superior to wettable sulphur. On the first day after its application, there were only 9–17 per cent. as many mites as there had been originally, and their numbers continued to decline. In two out of three tests, all mites were eradicated in eight days. It gave satisfactory control at the minimum rate of 57 lb. per acre. Applications of 5 per cent. dinitro-o-cresol at 60 lb. per acre and 2 per cent. DDT at 32 lb. were followed by complete absence of mites for two days, after which a few reappeared. Reductions of 50–80 per cent. were obtained with phenazine and diphenylamine. DDT appeared the best of the three substances tested against *T. alfreddugèsi* on the first day, sulphur on the seventh day and the two equal on the third day. Cryolite was much less effective.

Rude (C. S.) & Smith (C. L.). **DDT for Control of Gulf Coast and Spinose Ear Ticks,** p. 132. During the summer of 1943, tests were carried out in the coastal region of Texas with DDT for the control of *Amblyomma maculatum*, Koch, on the ears of range cattle. When 2 per cent. DDT incorporated into a non-drying adhesive was applied to the outside of the ear and the inside of the outer ear, 10 per cent. of the normal number of adult ticks attached themselves, but when 5 per cent. DDT was used, few adults were able to do so. The latter strength gave a highly satisfactory kill of the ticks present, and a high degree of protection from reinfestation for three weeks. This is approximately three times as long as the period of protection afforded by any of the treatments used by ranchmen. Neither mixture caused apparent injury to any of the 303 cattle treated. In tests on the control of *Otobius* (*Ornithodoros*) *megnini*, Dugès, in Texas, a non-drying adhesive containing 5 per cent. DDT was applied to the inside of the ears of 113 cattle without causing apparent injury. The treatment killed a large proportion of the ticks present and gave some protection from reinfestation, but the results were less satisfactory than those obtained with *A. maculatum*.

Lindquist (A. W.), Madden (A. H.), Wilson (H. G.) & Jones (H. A.). **The Effectiveness of DDT as a residual Spray against Houseflies,** pp. 132–134. Some results are given of studies begun in Florida in February 1943 in which it was found that DDT, applied as a spray in a suitable solvent, remains as a nearly invisible deposit after the liquid has volatilised and acts as a residual contact insecticide against house-flies [*Musca domestica*, L.]. The interiors of

wooden boxes, gauze and glass containers and rooms were sprayed with known amounts of DDT in different formulae, reared 4-day-old flies were then introduced at intervals, and the time required to knockdown half and all of the flies was recorded. After 115 days, the tests were discontinued until winter, when the final records were made after 265 days. Tests were carried out at 80–90°F. in spring and summer and at an average of 80°F. in winter. Controls showed no mortality during the test periods. The time required for complete knockdown at various intervals after spraying is shown for 5 per cent. DDT in ethylene dichloride, dibutyl phthalate, deodorised kerosene, a mixture containing 10 per cent. benzyl benzoate and 85 per cent. kerosene, and aqueous emulsions containing 20 per cent. ethylene dichloride or dibutyl phthalate or 10 per cent. benzyl benzoate with 10 per cent. kerosene, applied to unpainted wooden cages at the rate of 25 mg. DDT per sq. ft. More satisfactory results were obtained when ethylene dichloride or kerosene was the solvent than when dibutyl phthalate was used. Kerosene appeared to be the most desirable solvent for the immediate use of the armed forces. Knockdown was much faster after 265 days than after 115 days. The reason for this is uncertain. When various sprays containing DDT were applied to painted and unpainted wood surfaces, most of them proved less effective on surfaces painted 2–3 weeks earlier than on unpainted wood. This is believed to be due to the action of the solvent on the paint. The difference was not pronounced on the surfaces that had been painted for some time. A suspension prepared by mixing 10 parts of a finely divided mixture of DDT and talc and 2 parts of a wetting agent, such as sodium lauryl sulphate, gave excellent kills for as much as 75 days on painted surfaces, but its usefulness may be limited because of the visible residue. DDT was used on plastered walls with good results and was highly effective on metal and plastic gauze, but some of the solvents may react unfavourably on plastics. The sprays are sufficiently effective on all types of surfaces to be of distinct value in control.

Several tests in which DDT was applied in boxes showed a gradual increase in speed of knockdown as dosages rose from 10 to 200 mg. per sq. ft., but no appreciable difference with dosages ranging from 200 to 400 mg. Flies have been killed by dosages as low as 0·25 mg. per sq. ft., but the larger dosages retain residual toxicity longer. In two wooden boxes, one sprayed with 5 per cent. DDT in deodorised kerosene and cyclohexanone and the other with 5 per cent. DDT in kerosene, at 125 mg. active material per sq. ft., kills of 86 and 65 per cent., respectively, were effected after an exposure of one minute 158 days after treatment. Exposure for five minutes in the same boxes caused nearly complete kill. In wire gauze cages treated at the rate of 100 mg. DDT per sq. ft., exposure for five minutes 151 days after treatment resulted in almost complete kill. In these tests, the knockdown six hours after exposure was usually low. Mortality was practically the same after 24 and 48 hours. Counts made 18 hours after exposure showed 100, 92 and 86 per cent. kill in flies kept at 70, 90 and 100°F., respectively, after having been exposed to DDT at 65°F. until all were down (40 minutes), and 100, 100 and 98 per cent. kill in flies kept at the same three temperatures after having been exposed at 95°F. for 95 minutes (until all were down).

In practical tests, the walls and ceilings of the milk barn and feed room of a number of dairies were sprayed once with 5 per cent. DDT in kerosene. The immediate reduction in fly population was about 95 per cent., and numbers in the buildings continued to be much lower than those in untreated ones for several months [*cf.* **32** 175].

Van Leeuwen (E. R.). **Residual Effect of DDT against Houseflies,** p. 134. Experiments carried out in 1943 in Maryland to ascertain the period over which DDT would prevent populations of *Musca domestica*, L., from accumulating in buildings were of four types. The first was the small-cage test, in which two cages 9½ ins. in all dimensions and consisting of gauze walls, a glass door

and a metal bottom were used. One was sprayed on the inside with 21 cc. of a 2 per cent. solution of DDT in kerosene and the other with 92 cc. of a 1 per cent. suspension in water. House-flies were liberated in the cages from the day of spraying (3rd May) until 22nd September ; all were knocked down in 45–75 minutes, and none recovered. In tests with large cages measuring 4 ft. 6 ins. by 3 ft. 6 ins. by 6 ft. 8 ins. and having solid sides and bottom and a gauze top, all flies introduced between 21st May, the day on which the insides of the cages were sprayed with 280 cc. of a 1 per cent. suspension of DDT in water, and 22nd September, were knocked down in 60–120 minutes and none recovered. A room measuring 20 by 20 by 10 ft. with four screened windows in a dairy building was treated on 12th June with 6 U.S. gals. water containing 1 per cent. DDT, 1 per cent. pyrophyllite and 0·5 per cent. sodium lauryl sulphate. No animals were admitted. Flies were released in the room on 19th June and again at irregular intervals until 23rd September. The time required for complete knockdown increased over this period from 75 to 120 minutes, but no flies recovered. To determine the effectiveness of DDT under practical conditions, a heavily infested dairy barn, 140 ft. long, 36 ft. wide and 8 ft. 6 ins. high, with walls and ceiling painted white and accomodating 40 cows, was sprayed with 200 U.S. gals. of 1 per cent. suspension on 28th June by means of a power sprayer at 150 lb. pressure. This was enough to wet the ceiling and upper two-thirds of the walls without allowing any run-off. Before spraying, 312 flies were counted on 13 representative areas of walls and ceiling. During 38 observations made between 29th June and 8th October, the number on the same areas varied from 0 to 56, with an average of 10·8. As the counts were made when flies were entering the building to feed, many of those caught had probably not been in contact with the DDT long enough for it to take effect. When the doors and windows were closed for four hours, all flies succumbed. In each of nine other practical tests made during the summer, including one on a building housing pigs and another on one housing sheep, all flies present were destroyed and no considerable number accumulated after treatment.

Blakeslee (E. B.). **DDT as a Barn Spray in Stablefly Control,** pp. 134–135. During September and October 1943, several fairly large-scale tests with DDT for the control of *Stomoxys calcitrans,* L., were made in two screened stables on Florida beaches. Three applications, 10–12 days apart, were made in each stable with a solution of 2 gm. DDT per 100 cc. white kerosene applied as a mist with a knapsack sprayer at about 8 U.S. gals. to 2,000 sq. ft. of wall surface, which was enough to wet it without run-off. Before this treatment, the 44 horses accomodated in the stables were kept inside during bad outbreaks of *S. calcitrans* and a commercial spray was used to reduce the numbers of the flies. After the application of DDT, no further sprays were necessary to protect the animals.

A window screen treated with DDT in kerosene (5 gm. per 100 cc.) in an unsprayed building was still killing flies at the end of 13 days, when the observations ended. At another stable, an unoccupied section of eight stalls, screened from the remainder of the building, was treated with DDT in kerosene at 2 gm. per 100 cc. The doors were left open during the day, and thousands of flies entered the compartment. At night, the doors were kept closed and complete kill of the trapped flies was obtained for 12 days. After this the stalls had to be used, but appreciable protection to the horses in them was not evident. Sprays of DDT in various solvents were applied to horses at 4 oz. per animal twice daily, as many as 35 applications being made, and gave complete knockdown and kill of flies alighting on the animals in all cases. Except for its cost, the best combination was 2 gm. DDT in 100 cc. indalone ; one application gave complete kill of the flies on the horses, complete protection for 1 hour, satisfactory partial protection for 2–4 hours and a residual deposit on the animal that remained toxic to flies for a few days. DDT had no repellent effect and did not increase or reduce the repellency of any material to which it was added.

Simmons (S. W.) & Wright (M.). **The Use of DDT in the Treatment of Manure for Fly Control,** p. 135. Tests of emulsions of DDT against larvae of house-flies [*Musca domestica*, L.] in manure were carried out in Florida from November 1943 until the end of January 1944. The stock formula was 10 gm. DDT, 12·5 ml. benzene, 2·5 ml. B-1956 (phthalic glyceryl alkyd resin) and 75 ml. water. It was relatively stable and could be diluted in the field. The diluted emulsions were applied with a power sprayer at a pressure of about 350 lb., a semi-driving spray, obtained by throttling the gun, being used. Heaps of cow manure of about 16 cu. ft. in volume and well infested with larvae and pupae were sprayed with 8–10 U.S. gals. emulsion and caged. Over a period of 67 days, 13 flies emerged from two heaps treated with a 1 per cent. DDT emulsion and 555 emerged from two control heaps. Dead larvae and pupae were found in the treated heaps two days after spraying. Over a period of 65 days, two flies emerged from two heaps treated with a 0·5 per cent. emulsion and 1,008 from a single control heap. No flies emerged over a period of 18 days from two heaps sprayed with 0·25 per cent. DDT, two emerged from two sprayed with 0·1 per cent., and 940 emerged from the control heap. Tests to determine whether the benzene was giving an appreciable kill indicated that the amount in the strongest emulsion kills about 50 per cent. of the immature stages, but it is unlikely that the amount in the weakest emulsion would effect any considerable control.

Two piles of ground-nut litter measuring 2 cu. ft. and heavily infested with larvae and pupae of the stable fly [*Stomoxys calcitrans*, L.] [*cf.* **30** 61] were treated with 2 U.S. gals. 0·5 per cent. DDT, two with 2 U.S. gals 0·25 per cent. DDT and one caged as a control. From these three lots of piles 5, 2 and 204 flies emerged, respectively, over a period of 32 days. Since the minimum lethal dose of DDT was not determined in these tests, further work with more dilute sprays is being carried out.

Hunt (W. T.). **Relative Effectiveness of DDT and Rotenone against Houseflies,** p. 136, 1 ref. In laboratory tests by the spray tunnel method [**28** 240], the concentrations of rotenone and DDT in deodorised kerosene that left 57–58 per cent. of house-flies [*Musca domestica*, L.] active at the end of six hours were 0·25 and 1 gm., respectively, per litre, and those that left rather more than 20 per cent. active were 1 and 2·5 gm.

Wells (R. W.). **DDT as a Flyspray on Range Cattle,** pp. 136–137. During the summer of 1943, tests were carried out with DDT for the control of *Lyperosia* (*Siphona*) *irritans*, L., on cattle under ranch conditions in Texas. Three tests were made with aerosols containing 5 per cent. DDT, 10 per cent. of either sesame oil or acetophenone, 20 per cent. trichlortrifluoroethane and 65 per cent. methyl chloride. In one test, the 14 cattle in a pasture were all treated on 14th May, when they carried about 500 flies each. They bore no flies on the next day, the only flies found on the fourth day were 1–5 on each of three of the animals, and there were 5–6 on one animal on the seventh day. On the 14th day, the cattle carried 200-500 flies each, whereas there were about 1,000 per animal in control herds on the same ranch. In an adjoining pasture containing 15 cattle, seven were treated on 14th May, when the number of flies on them was estimated at 500 per animal. On the next day there were no flies on any of the 15 animals. On the fourth day, five animals carried 3–8 flies each, one unsprayed animal carried 10–15, and the other nine none. Only three flies were found on the seventh day, but there were 200-500 per animal by the fourteenth day. The only occupants of a small pasture, 5 yearling bulls, were treated over the back and on top of the head only on 15th May when they carried 800–1,200 flies each. There were only four or five flies among them on the third day and six on the seventh. On the 13th day, there were about 30 flies per animal, while a bull 100 yards away in another pasture carried 150, although it had been sprayed on the previous day with a popular oil-base spray, and a control herd half a mile away carried 1,500–2,000 flies each. In cage tests in which definite numbers of flies were

exposed on successive days to treated animals, the residue from the aerosol did not remain highly toxic after the fourth day. The longer protection given in pastures is attributed to the rapid destruction of the existing population of adult flies, which is only slowly renewed by freshly emerging adults. These may, moreover, be more susceptible than older ones to the residual poison in the hair. Methods of making the DDT crystals adhere to the hair appear to be desirable and are being studied.

Equally satisfactory control of *L. irritans* was obtained when the DDT was applied to the cattle in emulsions with a power sprayer at a pressure of 300 lb. In one operation, 90 cattle were sprayed all over with one nozzle in an hour. During hot weather, it is advisable to spray the bellies as well as the backs. The amount of emulsion used per animal was 2–3 U.S. pints. The cattle were free of flies within 30 minutes of spraying and remained practically so for a week. After 14 days, they had only one-third to one-half as many flies as untreated herds in other pastures on the same ranch. In one herd that was sprayed a second time two weeks after the first application, the cattle carried only 50–75 flies three weeks after the second spraying, while cattle that had been sprayed only once were again normally infested. It is anticipated that two sprayings in the spring and two in the autumn at an interval of two weeks will give adequate control. With a power sprayer, no advantage was obtained from using more than 0·2 per cent. DDT in the emulsions, but the results were not satisfactory when a 0·1 per cent. emulsion was used. Less than 2·5 per cent. was not satisfactory with a hand sprayer. The formulae that gave the best results were 100 gm. DDT, 140 ml. benzene, 140 ml. kerosene and 8 gm. Triton NE [an aralkyl polyether alcohol], and 100 gm. DDT, 140 ml. benzene, 140 ml. dibutyl phthalate and 12 gm. Triton NE, with the addition in both cases of water to make 1 litre. The second formula was the better as the dibutyl phthalate remains wet and appears to delay the formation and dissipation of the DDT crystals. The emulsions were stable and mixed readily with water.

Gersdorff (W. A.) & McGovran (E. R.). **Laboratory Tests on Houseflies with DDT in Contact Sprays,** p. 137. The comparative effectiveness against house-flies [*Musca domestica*, L.] of contact sprays containing DDT and pyrethrins in deodorised kerosene was tested by two methods. The DDT was of technical grade with a settling point of 91°C. Experiments by the turntable method [**26** 246] showed that DDT at concentrations above 2 mg. per ml. caused a pronounced knockdown in 10 minutes, but lower concentrations caused negligible knockdown. The toxicity of the DDT increased much more rapidly with an increase in concentration than did that of the pyrethrins, the two materials having the same toxicity at 0·7 mg. per ml. The concentrations calculated to give 50 per cent. kill were 1·65 mg. pyrethrins per ml. and 0·95 mg. DDT. Kerosene sprays containing 0·1 per cent. DDT with the addition of 0·03 or 0·05 per cent. pyrethrins, 2 per cent. fenchyl thiocyanoacetate (Thanite) or 2 per cent. butyl carbitol thiocyanate (Lethane 384) all gave 99 or 100 per cent. knockdown in 10 minutes and 98 or 100 per cent. kill in one day. The supplementary materials were chosen largely for their knockdown value. In the same periods, 0·1 per cent. DDT alone, and 0·1 and 0·2 per cent. pyrethrins alone gave 10, 100 and 100 per cent. knockdown and 81, 59, and 84 per cent. kill; respectively, and 0·05 per cent. DDT with 0·05 per cent. pyrethrins gave 100 per cent. knockdown and 92 per cent. kill. In tests by the Peet-Grady method [**16** 255], in which E. R. Van Leeuwen assisted, 0·2 per cent. DDT in deodorised kerosene combined with 0·03 per cent. pyrethrins, 1 per cent. fenchyl thiocyanoacetate or 1·5 per cent. of the commercial grade of butyl carbitol thiocyanate gave complete knockdown and kill when 12 ml. were used per test. DDT alone in deodorised kerosene caused less than 50 per cent. knockdown in 10 minutes when 0·5 per cent. or less was used. At 1 and 2 per cent., knockdown was much higher, but was not complete in 10 minutes.

Babcock (O. G.). **DDT for the Control of Goat Lice,** p. 138. All lice were killed soon after hatching when Angora goats in central Texas infested with *Holakartikos crassipes*, Rudow (*Trichodectes hermsi*, Kellogg & Nakayama), *Damalinia* (*T.*) *caprae*, Gurlt, and *D.* (*T.*) *limbata*, Gerv., were dipped in 0·3 or 0·6 per cent. DDT in a water emulsion, and no reinfestation developed during the next 26 days. In another test, Angora goats infested with *Linognathus stenopsis*, Burm., as well as the Trichodectids were dipped in water emulsions containing 0·3, 0·15, 0·07 and 0·04 per cent. DDT. All concentrations killed all the Trichodectids, and all except the weakest gave complete kill of *L. stenopsis*. There was no evidence of reinfestation during the next 25 days. The DDT apparently had no effect on the hair or skin of the goats.

Lindquist (A. W.), Madden (A. H.) & Knipling (E. F.). **DDT as a Treatment for Fleas on Dogs,** p. 138. In preliminary tests against *Ctenocephalides canis*, Curt., *C. felis*, Bch., and *Echidnophaga gallinacea*, Westw., on dogs, powders containing 4 or 5 per cent. DDT in pyrophyllite were thoroughly rubbed into the hair of 11 dogs, about 10 gm. being used for a medium-sized animal. The species of *Ctenocephalides* began to drop to the ground within 10–15 minutes. Some of these fleas died on the dogs, but most of them left the host and showed the reactions characteristic of insects affected with DDT, such as spasmodic twitching of the appendages [*cf.* **32** 179]. Individuals kept for observation died in 3–5 hours. *E. gallinacea* died on the host. Treated dogs were completely freed of fleas and protected from reinfestation for 4–7 days, while untreated dogs continued to harbour large populations, and dogs treated with a derris powder containing 4·8 per cent. rotenone were protected for only 2 days. None of the dogs showed any ill effects from the treatment.

Morrill jr. (A. W.). **DDT as a Roach Poison,** p. 138. Four batches of ten adults each of *Periplaneta americana*, L., and *Blattella germanica*, L., were fed for three weeks on a mixture containing 1 gm. DDT dry or in 10 cc. acetone, and 100 gm. dog biscuit or mouse food, and all died. Of ten of each species given 1 gm. DDT in 10 cc. acetone and a mixture of 50 gm. mouse food and 50 gm. dog biscuit with 10 cc. glycerin and 5 cc. amyl acetate, one individual of *P. americana* survived. The same numbers of control cockroaches fed on untreated dog biscuits were all alive at the end of the test period. Five adults of each species were placed in each of 20 jars containing a vial of water and a few untreated dog biscuits. A wire basket containing a mixture of equal parts of dog biscuit and mouse food ground together with the addition of 1 gm. DDT to 50, 100, 500 and 1,000 gm. food was introduced into each jar, each rate being used in five jars. After 10 days, 1, 4, 7 and 20 adults of *P. americana* and 6, 14, 25 and 25 of *B. germanica* were alive in the respective mixtures [*cf.* **32** 156–157]. All the 25 adults of each species fed on dog biscuits as controls remained alive.

Gahan (J. B.) & Knipling (E. F.). **Efficacy of DDT as a Roach Poison,** pp. 138–139. An account is given of tests in Florida to determine the practicability of using DDT against cockroaches. Adults of *Periplaneta americana*, L., and *Blattella germanica*, L., confined in small pens, 14 ins. square, with a one-inch strip of dust containing 5 per cent. DDT across the centre were all dead within 48 hours. In similar tests with *P. americana* only, 0·1 per cent. DDT gave complete kill in 96 hours. When 5 per cent. DDT and undiluted sodium fluoride were compared against *P. americana* in large pens, all the cockroaches exposed to DDT were on their backs within 48 hours and dead 24 hours later, whereas only 60 per cent. of those exposed to sodium fluoride were dead after 144 hours. In two tests in which adults of both species were allowed to run once across a narrow band of powder containing 5 per cent. DDT, mortalities of 30 and 40 per cent. were obtained in 96 hours with *B. germanica* and complete mortality in 48 and 72 hours with *P. americana*. When the concentration of DDT was reduced to 0·5 per cent., 83 per cent. mortality of adults of *P. americana* occurred in 72 hours, but 0·1 per cent. DDT was ineffective. Undiluted sodium

fluoride required 72 and 144 hours to give mortalities of 50 and 80 per cent., respectively, of *P. americana* under the same conditions.

In practical tests in mess rooms heavily infested with *B. germanica*, a spray made by dissolving DDT in an equal weight of cyclohexanone and mixing 2 gals. of this solution with 25 gals. kerosene was used in two buildings, and a water emulsion containing 5 per cent. DDT, 15 per cent. xylene and 5 per cent. Triton NE (an aralkyl polyether alcohol) in a third. Four and two other buildings were dusted, respectively, with 25 and 10 per cent. DDT in talc. The dusts were applied only to hiding places, the edges of rooms and the floor under stationary furniture, but the sprays were also applied to all wall surfaces made of wood or plaster board. The weight of DDT used per 100 sq. ft. of floor space varied between 18 and 95 gm. in the halls that were sprayed and between 19 and 29 in those that were dusted. Very large numbers of cockroaches were killed by all the treatments, the sprays giving almost immediate results and the dusts showing delayed action. Complete eradication was not obtained from any of the buildings, but it is doubtful whether this could ever be effected in Florida, as the cockroaches can breed out of doors and there is thus a constant source of reinfestation. The people working in the buildings considered the results satisfactory. Populations seem to have been most reduced in the dusted buildings. Dust deposits are unsightly, whereas the residues of kerosene sprays are practically invisible, but the results so far obtained indicate that spray residue will not give protection from *B. germanica* for more than a few days. A theatre infested with *B. germanica* was treated with a water emulsion containing 2·5 per cent. DDT, 5 per cent. xylene and 0·1 per cent. Triton NE at the rate of about 1 U.S. gal. to 300 seats. Living cockroaches were found 14 days later, but the populations had noticeably decreased. On 2nd September 1943, a dairy was sprayed with a mixture containing 2 per cent. DDT, 2 per cent. Nopco 1216 (a sulphated sperm oil) and 10 per cent. acetone at 18·5 gm. DDT per 100 sq. ft. for the control of flies. Upon examination two days later, large numbers of adults and nymphs of *P. americana* were found on the floor of the building and the ground surrounding it, and dead cockroaches were still being found two weeks after treatment.

McGovran (E. R.), Richardson (H. H.) & Piquett (P. G.). **Toxicity of DDT to Bedbugs, Cockroaches, the Mexican Bean Beetle and Housefly Larvae,** pp. 139–140. At a concentration of 0·18 per cent. (weight in volume) in deodorised kerosene applied as a contact spray by the turntable method [**26** 246], DDT was highly toxic to *Cimex lectularius*, L., and *C. hemipterus*, F. It was as toxic as the same concentration of pyrethrins, although the lethal effect was not complete for 2–4 days while that of pyrethrum extract was complete in one day. DDT sprays appeared to have little effect on the eggs of the bugs.

A kerosene spray containing 2 per cent. DDT applied to the dorsal surface by the pendulum method [**30** 194] was less effective against *Blattella germanica*, L., than one containing 0·4 per cent. pyrethrins, and was ineffective against *Periplaneta americana*, L. It showed appreciable toxicity to *P. americana* when it was tested by confining the cockroaches in a rising mist of spray, but was less effective than a similar spray containing 0·2 per cent. pyrethrins. The cockroaches were not knocked down rapidly by the DDT sprays. Equal deposits of powders containing 3 per cent. DDT and 0·66 per cent. pyrethrins caused about equal mortality of *B. germanica*, but the pyrethrum powder was the more effective against *P. americana*. A dust containing 10 per cent. DDT in pyrophyllite was less effective against each species than finely ground commercial (95 per cent.) sodium fluoride, but, on the basis of the amount of the active ingredient in each powder, it was more so.

When samples of breeding media of *Musca domestica*, L., weighing about 23 gm. each were treated, respectively, with 30 and 60 mg. DDT, 60 mg. borax and 7·5 mg. thiourea and infested with third-instar larvae, 77, 88, 92 and 92 per cent. of the larvae died.

Swingle (M. C.) & Mayer (E. L.). **Laboratory Tests of DDT against various Insect Pests,** pp. 141–142. The insects used in these experiments included *Periplaneta americana*, L. The percentages of adults killed when confined on surfaces treated with dusts were 100 in 18 hours by 5 per cent. DDT, 100 within 48 hours by 1 per cent. DDT, 0 in 72 hours by 10 per cent. sodium fluoride, and 65 in 72 hours by 5 per cent. pyrethrum. When large nymphs were confined for 3 days on the deposit from a spray containing DDT, 92 per cent. mortality was obtained.

Williams jr. (L. L.) & Hollis (M. D.). **Malaria Control in the War Areas.**—*J. nat. Malar. Soc.* **2** no. 2 pp. 5–9. Tallahassee, Fla., 1943.

After the entry of the United States into the war in 1941, funds were allocated to the Public Health Service for carrying out anti-malaria measures in war areas in co-operation with the State Health Departments. Operations were at first restricted to the fifteen south-eastern States and Porto Rico, but other areas in the United States were added later. The object is to control breeding of malaria-carrying Anophelines and reduce transmission in areas contiguous to military reservations (within which mosquito control is carried out by the Army or Navy) and in areas of essential war industries. Surveys of pest mosquitos and the control of *Aëdes aegypti*, L., are authorised only where such measures have a definite significance in connection with the war. Surveys at 13 southern ports of entry showed *A. aegypti* indices ranging from 20 to 40.

Medical, engineering and entomological services are closely coordinated. The main measure taken against malaria is the application of larvicides to all Anopheline breeding places within flight range of a protected war establishment, and minor drainage and clearing operations and occasionally major ones are also carried out. Installation of permanent ditch lining is restricted to systems where the hydraulic gradient requires the use of lining, or where the ditches are an integral part of a drainage system of a permanent community and the necessary materials are obtainable locally. Data are given on the work done in the five months ending 1st November 1942 and the equipment used. Control was adequate, and no outbreak of malaria was reported in any of the areas during the season. The administrative organisation, and difficulties experienced owing to war conditions are also discussed.

Rector (N. H.). **Anti-malaria Ditching by Dynamite.**—*J. nat. Malar. Soc.* **2** no. 2 pp. 11–20, 4 pls. Tallahassee, Fla., 1943.

Blasting is a quick, economical and labour-saving method of opening ditches for Anopheline control, particularly in wet ground [*cf. R.A.E.*, B **32** 130]. By placing equal charges of dynamite in a line or lines of holes at given intervals and depths and detonating them simultaneously, a ditch of regular width and depth can be obtained. Very little clearing should be necessary after the blasting. A qualified engineer should determine the specifications of the ditch. Brief descriptions of the propagation and electric methods of blasting, and an account of the preparatory procedure are given, and notes are included on the economical construction of outlet ditches across bends in old natural channels, and on vertical drainage of ponds or pits where the substratum is suitable and there is no danger to health through the contamination of ground water.

Certain items in the paper are discussed by R. E. Dorer (pp. 15–17) and by J. E. Taylor in a contribution entitled "Dynamite Ditching" (pp. 17–20), the latter giving particular attention to the bearing of the type of soil on the successful use of blasting.

Bradley (G. H.) & Hanson (H. G.). **Entomological Services in the Regulation of the Larvicide Program.**—*J. nat. Malar. Soc.* **2** no. 2 pp. 21–28, 3 figs. Tallahassee, Fla., 1943.

Recent experience gained in the United States by the service for malaria control in war areas has given additional evidence that malaria transmission by *Anopheles quadrimaculatus*, Say, can be prevented by controlling its breeding within one mile of the establishments to be protected [*cf. R.A.E.*, B **30** 74]. The policy of the service was to treat only breeding places in which *A. quadrimaculatus* had been found, but it was not always possible to adhere to this on account of lack of trained staff. The organisation and the routine duties of the inspectors, who visited all known breeding places and adult index stations weekly, are described.

King (W. V.) & Kuhns (D. M.). **Development of entomological Service of the Fourth Service Command Laboratory as applied to the Army's Mosquito Control Program.**—*J. nat. Malar. Soc.* **2** no. 2 pp. 39–47, 1 map, 1 fig. Tallahassee, Fla., 1943.

An account is given of the organisation of a service for malaria and mosquito control by the medical department of the Army in the south-eastern United States. After the declaration of war in December 1941, a uniform system of recording mosquito collections was instituted to provide information on the cantonment areas having a high population of *Anopheles quadrimaculatus*, Say, and therefore requiring a malaria control programme, those having species of importance as pests, the sources of production of these mosquitos and the efficacy of the control programme. Instructions were issued that adults of *A. quadrimaculatus* should be collected weekly from natural and, if necessary, artificial resting places, that about 1–5 New Jersey suction light-traps [*R.A.E.*, B **31** 195, etc.] should be operated per post, preferably throughout the night on 3–5 nights a week, that biting records should be taken for 30 minutes after nightfall, and that larvae should be collected by dipping in representative parts of all the potential breeding places within a mile of the cantonment area, and outside this radius when pest species were numerous. The total number of adults and larvae identified from army posts in the Command during the 1942 mosquito season (April-September inclusive) and the numbers of adults of *A. quadrimaculatus* taken by three collecting methods are shown in tables. In general, the population of *A. quadrimaculatus* was low, and there was little evidence of active malaria transmission during 1941 or 1942. *A. crucians georgianus*, King, was found in all the south Atlantic and Gulf States from North Carolina to western Louisiana [**32** 194], but there is no evidence that it is of importance in the transmission of malaria.

Legwen (W. A.). **Malaria Control Experience with Circular Joint Ditch Paving Slabs and Automatic Siphons.**—*J. nat. Malar. Soc.* **2** no. 2 pp. 61–64, 2 pls. Tallahassee, Fla., 1943.

Data based on experience in 1942 are given to show that the labour costs of circular-joint ditch paving [*R.A.E.*, B **31** 217] compare favourably with those for other types of paving. The installation of two automatic siphons [**31** 217] in Georgia is also described. One was effective in the control of *Anopheles quadrimaculatus*, Say, breeding in a ditch; the other was installed too late for its effectiveness to be demonstrated conclusively, but it caused satisfactory fluctuations in the level of a pool fed by springs, and numerous Anopheline larvae were drawn into it and discharged downstream.

Eyles (D. E.) & Cox (W. W.). **The Measurement of a Population of *Anopheles quadrimaculatus* Say.**—*J. nat. Malar. Soc.* **2** no. 2 pp. 71–83, 3 figs., 6 refs. Tallahassee, Fla., 1943.

This paper deals with three experiments carried out in July and August 1942 near Reelfoot Lake, Tennessee, on the application of Jackson's technique for estimating populations of *Glossina morsitans*, Westw. [*R.A.E.*, B **28** 140; *cf.* also **29** 123, etc.] to females of *Anopheles quadrimaculatus*, Say. The procedure of catching and examining the mosquitos, which enabled large numbers to be dealt with, is described in the next paper. A representative sample was taken from barns, marked and immediately released over the experimental area; the first recapture was made after three days and five others after three-day intervals. By a method that is described, an interval of three days was found to be required to allow intimate mixing of the marked mosquitos with the general population. The proportion of marked individuals in the successive captures decreases on account of death and emigration; if environmental conditions are uniform, it should do so in geometrical progression. This makes it possible to extrapolate the curve obtained to the day of release and estimate the proportion of marked females that would have been recovered had it been practicable to recapture immediately after release and from it the population present. The processes followed in doing this and in calculating the error are shown. Numbers of live mosquitos were estimated by comparing the bulk or the weight of the catch with that of a known number and those of dead mosquitos from the weight. Detailed data on the catches at Reelfoot Lake are given, and it is concluded from them that the numbers of females present per acre in this area of exceptionally high density were 14,750, 8,500 and 10,125 on 13th and 27th July and 10th August, respectively.

Eyles (D. E.). **A Method for catching, marking, and reexamining large Numbers of *Anopheles quadrimaculatus* Say.**—*J. nat. Malar. Soc.* **2** no. 2 pp. 85–91, 5 figs., 3 refs. Tallahassee, Fla., 1943.

The apparatus used for catching large numbers of mosquitos alive [see preceding abstract] is described. It consists of a vacuum cleaner with a catching chamber attached to the free end of a cleaner tube twice the usual length. The chamber is made from two tins $6\frac{3}{8}$ inches in diameter and set end to end. Disks 5 inches in diameter are cut from the bottom of one tin and the top of the other and the residual rims are screwed together with a piece of bobbinet and a gasket of rubber between them. A sink drain piece to which the cleaner tube is fastened is mounted at the bottom of the lower tin and an intake "spout" 2×4 inches in cross section is fixed to the top of the upper one. The mosquitos are drawn into the spout by a rapidly moving stream of air and brought into the chamber, where the air movement is distributed over a much greater area. With this apparatus, 2,000–3,000 mosquitos can be caught at one time without injury, and 40,000 were once taken in the course of six hours. Mortality among mosquitos kept in the catching chamber for 15 minutes was no greater than among controls caught by forcing them to fly into an open-ended cage. The number of mosquitos taken can be estimated on the basis of previous counts of catches of the same capacity or by weighing the catch and calculating from the weight of a known number. The latter method is considered the more accurate.

When the mosquitos were to be killed, they were caught in a chamber, 2 inches in diameter and 8 inches long, separated into two compartments of unequal size by a bobbinet screen near the lower end, and attached to the vacuum cleaner tube by means of a rubber adaptor. After the catch was made, each end of the chamber was closed with a cap, a plug of cotton-wool moistened with chloroform having previously been placed in the lower compartment. Only 500–1,000 mosquitos could be caught at one time by this method, which is a modification of one previously described [*R.A.E.*, B **32** 41].

Mosquitos to be released were marked with fine aluminium or gold bronzing dust by means of an atomiser [*cf. loc. cit.*]. The markings were shown to last for at least 26 days, and were not transferred from one individual to another. Mosquitos thus treated can be examined for markings macroscopically at the rate of 15,000–25,000 a day, by pouring about 200 at a time into a white pan and examining each under the light of a microscope lamp.

Hess (A. D.) & Hall (T. F.). **The Intersection Line as a Factor in Anopheline Ecology.**—*J. nat. Malar. Soc.* **2** no. 2 pp. 93–98, 2 figs., 4 refs. Tallahassee, Fla., 1943.

"Intersection line" is defined as the line of intersection between three interfaces, water-air, water-plant and plant-air and "intersection value" as the number of metres of intersection line per square metre of water surface. During July and August 1942, a study was made of the relation between the intersection value and population of larvae of *Anopheles quadrimaculatus*, Say, in 111 areas of the Wheeler Reservoir in the Tennessee Valley, each $\frac{1}{4}$ sq. m. in extent and containing leaves of *Nelumbo lutea* as the only floating vegetation. Wooden frames were used to enclose each sample area, and observations indicated that Anopheline larvae did not escape from the frames when disturbed. The intersection value increased with the number of floating leaves up to the point where the leaves began to overlap; it then decreased until the leaves covered the whole surface when it was zero. There was a close positive correlation between the density of larvae of *A. quadrimaculatus* and the intersection value. Consequently, larval densities were highest when there was a medium cover and low with much or little cover. It is pointed out that the relation between the amount of cover and the intersection value will not be the same for different types of vegetation or for the same type in different situations. Several possible reasons for the correlation between larval density and intersection value are suggested. It explains previous failure to establish correlations between larval densities and plant cover and between larval densities and the amount of flotage, and variation in the effectiveness of fluctuation of water level in controlling Anopheline larvae in different types of vegetation.

Wilson (C. S.), Mathieson (D. R.) & Jackowski (L. A.). **Ingested Thiamin Chloride as a Mosquito Repellent.**—*Science* **100** no. 2590 p. 147, 1 ref. Lancaster, Pa., 1944.

Thiamin chloride (vitamin B_1 hydrochloride) has been reported by W. R. Shannon (*Minnesota Med.* **26** 1943 p. 799) to relieve the irritation of mosquito bites and to prevent further biting. A dose of 80–100 mg. on the first day and about 10 mg. per day afterwards was considered sufficient when taken by the mouth. The series of experiments here described, however, afforded no evidence that larger doses protected the men who took them from attack by *Aëdes aegypti*, L., or affected their reactions to its bites.

Richman (E.) & Deay (H. O.). **Preliminary Report on Mosquito Repellents.**—*Proc. Ind. Acad. Sci.* **52** (1942) pp. 192–195, 3 figs., 1 ref. Notre Dame, Ind. [?1944].

In 1942, various mosquito repellents were tested in Indiana by a technique already noticed [*R.A.E.*, B **29** 65] on six men who differed in susceptibility to mosquito attack. The commonest of the mosquitos present during the tests was *Aëdes vexans*, Mg. The results with the five repellents that showed most promise are given in a graph and discussed. The longest average periods of protection, 63 and 62 minutes, respectively, were afforded by a mixture of four parts diethylene glycol monoethyl ether acetate and one part of castor oil and by the proprietary preparation, Sta-way [*cf. loc. cit.*]. The former did not

affect the skin ; the latter sometimes caused slight irritation and stained cloth more than any of the other repellents, but it was the most consistent in its efficiency on the different men. These repellents and two of the others protected only the area of the skin to which they were applied, but a mixture of one part cedar-wood oil, two parts citronella oil and two parts spirits of camphor kept the mosquitos away from the immediate vicinity of the man for a distance of 5–10 feet. The average period of protection it afforded, however, was only 20 minutes.

CABLE (R. M.). **The Indian Rat Flea, *Xenopsylla cheopis*, in Indiana.**—*Proc. Ind. Acad. Sci.* **52** (1942) pp. 201–202, 10 refs. Notre Dame, Ind. [?1944].

Records of the occurrence of *Xenopsylla cheopis*, Roths., in the interior of the United States are reviewed [*cf. R.A.E.*, B **29** 135; **30** 34, etc.], and details are given of its occurrence on wild rats at Purdue University, Indiana, in 1939 and of its spread from them to laboratory rodents in 1941 and 1942.

TAYLOR (F. H.). **The intermediary Hosts of Malaria in the Netherlands Indies.**—*Serv. Publ.* (*Sch. publ. Hlth trop. Med.*) *Dep. Hlth Aust.* no. 5, 85 pp., 15 maps, 24 figs., 6 refs. Sydney, 1943.

Keys to the females and fourth-instar larvae of the species of Anophelines of the Malayan Region (Siam, Indo-China, Malaya, Sumatra, Java and Borneo) and the Australian Region are quoted from Russell, Rozeboom & Stone [*R.A.E.*, B **32** 102], and a key to the adults and larvae of the subgenera of *Anopheles* is included. Descriptions are given of the egg, larva and adult of the genus *Anopheles*, the larva, pupa and adult of the subgenera *Anopheles* and *Myzomyia*, and various stages of the species that are known or thought to transmit malaria in the Netherlands Indies, accompanied in many cases by notes on their distribution, breeding places, feeding and resting habits and relation to disease. The information is assembled from the works of Christophers [**21** 280], Gater [**22** 177 ; **24** 99], Swellengrebel & Rodenwaldt [**29** 120] and the author [**32** 95].

DOWNS (W. G.), GILLETTE (H. P. S.) & SHANNON (R. C.). **A Malaria Survey of Trinidad and Tobago, British West Indies.**—*J. nat. Malar. Soc.* **2** no. 1 Suppl. 44 pp., 12 maps, 1 graph, 21 refs. [Tallahassee, Fla.] 1943.

The following is almost entirely based on the authors' summary. Examination of about 25 per cent. of the children between the ages of 5 and 15 years in Trinidad and Tobago showed a spleen index of 8·4 per cent. Examination of 8,549 blood smears indicated that *Plasmodium falciparum* is the commonest malaria parasite, *P. vivax* being next in prevalence and *P. malariae* least common. However, in some of the more malarious regions *P. malariae* equalled or exceeded *P. vivax* in frequency.

Of the 13 species of *Anopheles* found in Trinidad, only five occurred in sufficient numbers to direct attention to them as possible important vectors of malaria. Of these, *A. aquasalis*, Curry, *A. oswaldoi*, Peryassú, *A. albitarsis*, Arrib., and *A. neomaculipalpus*, Curry, breed in ground waters and *A. bellator*, D. & K., in Bromeliads on trees [*cf. R.A.E.*, B **30** 133]. Of 1,383 stomachs and 1,364 salivary glands of females of *A. aquasalis* caught in houses, 46 and 1 were positive, respectively, on dissection, and of 1,263 stomachs and 1,348 salivary glands of females of *A. bellator* caught out of doors 10 and 0, respectively, were positive. Dissection of 386 stomachs and 350 salivary glands of females of *A. aquasalis* from stables and of very small numbers of *A. albitarsis* from houses, *A. oswaldoi* and *A. neomaculipalpus* from stables and *A. homunculus*, Komp, and *A. apicimacula*, D. & K., taken out of doors yielded negative results. In experimental feedings, *A. aquasalis*, *A. bellator* and *A. albitarsis* were all very susceptible to infection with *P. falciparum*. Insufficient work was done with *A.*

oswaldoi and *A. neomaculipalpus* for definite conclusions to be drawn regarding their susceptibility. This also applies to work with *P. vivax*. *P. falciparum* was transmitted in one instance by the bite of two experimentally infected females of *A. aquasalis* and in another by the bite of one similarly infected female of *A. bellator*. There was a close correlation in both islands between the presence of malaria and that of *A. aquasalis* or *A. bellator* or both, and also in Trinidad between the density of adults of *A. bellator*, spleen rates and rainfall. About half of Trinidad is free from malaria. In the remaining portions, it is transmitted by *A. aquasalis* or *A. bellator* [*loc. cit.*] or occasionally by both, and control must be directed against whichever of these species is present. *A. aquasalis* is the only vector among the three species found in Tobago.

ROUBAUD (E.). **Sur les variations évolutives observées chez les larves de culicides. Ralentissement et deuto-diapause chez l'*Aëdes detritus* Hal.**—*Bull. Soc. Path. exot.* **36** no. 9–10 pp. 274–279, 1 pl., 7 refs. Paris, 1943.

Three larvae that hatched in January 1942 from eggs laid by females of a salt-water strain of *Aëdes detritus*, Hal., from the Rhône delta were reared together in fresh water at 13–20°C. [55·4–68°F.]. One male and one female emerged after 15 and 16 days, respectively, and one male after 22 days. In view of the discrepancy in the developmental periods, a further experiment was made with nine larvae from eggs that had been laid in June 1942 by females of a strain from the interior of Crau thought to breed in fresh water ; these eggs had been kept on water at room temperature until February 1943 when they were immersed and hatched. Four of the larvae were reared in fresh water and five in salt water from a breeding place of *A. detritus*. In the first group, two females emerged in 23 and 46 days, and one male in 59 days ; in the second, two females emerged in 24 and 37 days and two males in 33 and 52 days. All these adults were normal. In each lot, one larva remained in the fourth instar after nearly two months. These two larvae were sluggish and contained much fat and had practically no food in the digestive tract. They had the typical appearance of larvae in winter diapause. It is thought that *A. detritus* like *A. geniculatus*, Ol. [*R.A.E.*, B **14** 123] can undergo diapause both in the first larval instar in the egg and also in the last larval instar. This probably gives the species two means of surviving the winter. It is also suggested that retardation of development in the fourth instar may follow an insufficient diapause in the egg. It is pointed out that the eggs used in these experiments had undergone neither the effect of exterior winter conditions nor anhydrobiosis.

ROUBAUD (E.) & GIRARD (G.). **Observations sur deux pulicides de la faune de Madagascar.**—*Bull. Soc. Path. exot.* **36** no. 9–10 pp. 279–281, 5 refs. Paris, 1943.

Several examples of *Paractenopsyllus kerguisteli*, Wagner, which was described from dogs and house rats in Madagascar in 1938 [*R.A.E.*, B **26** 144], were recovered from an unidentified species of *Mus* (*Rattus*) from the eastern forest in the same year, and numerous specimens have been found among ectoparasites collected in 1910 from a burrowing Centetid (*Oryzorictes tetradactylus*). Characters distinguishing it from *Leptopsylla segnis*, Schönh. (*Ctenopsyllus musculi*, Dugès) are given. One individual of *Synopsyllus fonquernii*, Wagn. & Roub., which is known to occur on hedgehogs and *Centetes* and to have become common on house rats in Madagascar [*cf.* **31** 87, etc.] was taken on an arboreal lemur (*Microcebus myoxinus*). Thus, both *P. kerguisteli* and *S. fonquernii* are able to infest animals of very diverse types and habitats.

Parrot (L.) & Gougis (R.). **Sur l'agent probable de transmission du bouton d'orient dans la colonie du Niger.**—*Arch. Inst. Pasteur Algérie* **21** no. 4 pp. 268–269, 9 refs. Algiers, 1943.

The only species of *Phlebotomus* hitherto known to occur in the colony of the Niger in French West Africa, in parts of which cutaneous leishmaniasis is endemic, was *P. sergenti*, Parr. [*R.A.E.*, B **23** 250], which was recorded from Aïr. At the end of June 1943, three males and one female of *P. roubaudi*, Newst., were taken in the dwelling of an infected European at Maradi. Characters are given for distinguishing this species from *P. papatasii*, Scop., to which it is very closely allied. In view of this close relationship and the known efficiency of *P. papatasii* as a vector of the causal organism of the disease [*Leishmania tropica*], it is considered highly probable that *P. roubaudi* is the vector in this district.

[Khokhlova-Buyanova (O. F.).] **Хохлова-Буянова (О. Ф.). On the Reaction of *Phlebotomus* to different Stimuli in Relation to its Distribution in Houses.** [*In Russian.*]—*Zool. Zh.* **22** fasc. 2 pp. 67–72, 8 refs. Moscow, 1943. (With a Summary in English.)

Laboratory experiments similar to those of Polezhaev with mosquitos [*cf.* *R.A.E.*, B **25** 141] were carried out in the summer of 1939 in Sebastopol to ascertain the effect of light on *Phlebotomus papatasii*, Scop. When sandflies in a transparent cage were disturbed, they all flew immediately towards the wall that was illuminated (796 lux), but soon settled on other walls as well, though about 40 per cent. were still on the illuminated wall after 10 minutes. If sandflies were disturbed when the cage was between a window and an electric lamp producing illuminations of 190 and 145 lux, respectively, on the walls, they always flew first towards the window, but again soon distributed themselves evenly over all the walls. The initial flight towards the window occurred even if the illumination of the wall nearest it was reduced to 48 lux and that of the wall nearest to the electric light was increased to 500 lux, which showed that sandflies, like mosquitos [*loc. cit.*], are more attracted by a large illuminated surface than by a small though brighter light.

In another series of experiments, fully fed females or hungry ones that had completed digestion were placed in a plywood box painted black on the inside, in which the front wall was replaced by a translucent screen through which light of various intensities was admitted. In some cases, the screen consisted of adhesive paper so that sandflies alighting on it were caught. The sandflies were disturbed in darkness five minutes before the box was illuminated and then exposed to light for five minutes. Most of them settled on the wall opposite the translucent screen, which was lighter than the other walls, but the fed females did not react in this way unless the intensity of light on this wall was at least 27 lux, whereas the hungry ones did so when it was only 5 lux. It is thought probable that this back wall functioned as a second light screen, and that the sandflies alighted more readily on it than on the smoother surface of the screen that admitted the light. The numbers of the sandflies caught on the adhesive paper were little greater than in a control experiment in which the box was not illuminated, but were greater in hungry than in fed females, showing that positive phototaxis in the reaction of escape is more sharply defined in the former.

Observations in inhabited houses showed that differences in light intensity do not affect the selection by sandflies of places in which to rest during the day, provided that the intensity is not greater than 336 lux. From these observations and others in insectaries, it is concluded that sandflies are negatively geotactic and, to a less extent, positively thigmotactic, as they usually settle near the ceiling and tend to congregate close together in corners and to hide in cracks.

Sandflies entering inhabited rooms through open windows were caught on an adhesive screen fixed in the centre of each window and also on strips of adhesive paper round the edges of the frame, showing that some fly in directly and others alight when entering. Twice as many males were caught as females, and twice as many hungry females as engorged ones.

[Blagoveshchenskiĭ (D. I.), Bregetova (N. G.) & Monchadskiĭ (A. S.).] **Благовещенский (Д. И.), Брегетова (Н. Г.) и Мончадский (А. С.). Activity in Mosquito Attacks under natural Conditions and its diurnal Periodicity.** [*In Russian.*]—*Zool. Zh.* **22** fasc. 3 pp. 138–153, 3 graphs, 3 refs. Moscow, 1943. (With a Summary in English.)

An account is given of observations in August and September 1942 to ascertain the hours of the day and night during which mosquitos are active in south-western Tadzhikistan and the factors that affect their activity. The blood-sucking Diptera that settled on a man sitting motionless on a spot cleared of vegetation were collected periodically in a bell-shaped cover that was placed over him and records were taken of the time of day, temperature and relative humidity. The effect of light intensity was not studied, and there was no wind during the period of investigation. The results are shown in detail in tables. Over 93 per cent. of the blood-sucking Diptera taken were mosquitos, and 94·3 per cent. of the mosquitos were females of *Mansonia richiardii*, Fic. Anophelines (*Anopheles superpictus*, Grassi, and *A. hyrcanus*, Pall.) made up only 1 per cent. of the catch, though *A. superpictus* was the most common mosquito in houses and a cow-shed nearby.

Temperature and not relative humidity appeared to be the factor that affected the activity of the mosquitos, and their daily rhythm of activity was correlated with it. Attacks on man reached a peak at 13–19°C. [55·4–66·2°F.] and declined with a rise or fall in temperature, ceasing completely above 31°C. [87·8°F.] or below 7°C. [44·6°F.]. The first half of the observation period was warm and the second cold. The temperatures during the warm period were seldom low enough by night or high enough by day to cause an absolutely complete cessation of activity, but it was practically confined to the periods between 7 and 10 a.m. and between sunset and midnight, with peaks at 8–9 a.m. and 8.30–11 p.m., when the temperature was about 18°C. [64·4°F.]. The main effect of the cool period was to reduce activity and cause it to begin later in the morning and end earlier at night. It is probable, therefore, that the two periods of activity will merge into one at still lower or higher temperatures, so that mosquitos will be found to feed throughout the night in the heat of summer and only during the hottest hours of the day in spring and late autumn.

[Pervomaĭskiĭ (G. S.).] **Первомайский (Г. С.). On the Infestation of** *Ixodes persulcatus* **by** *Hunterellus hookeri* **How. (Hymenoptera).** [*In Russian.*]—*Zool. Zh.* **22** fasc. 4 pp. 211–213. Moscow, 1943. (With a Summary in English.)

Of 1,276 engorged nymphs of *Ixodes persulcatus*, Schulze, and 476 of *Haemaphysalis* spp., collected from small mammals and birds between 15th June and 1st August 1941 in a focus of tick-borne encephalitis in the Ussuri primeval forest (taĭga), Russian Far East [*cf. R.A.E.*, B **31** 70], 93 and 91, respectively, were found to be parasitised by *Hunterellus hookeri*, How., 1,228 adults of which emerged from them between 8th August and 10th October. The nymphs were kept at 20–24°C. [68–75·2°F.] in August, 18–22°C. [64·4–71·6°F.] in September, and 14–16°C. [57·2–60·8°F.] in the first ten days of October. At 14–18°C. [57·2–64·4°F.], the parasites were able to live in test tubes for 6–12 days, and the females oviposited in larvae and nymphs of the ticks.

[Denisova (Z. M.).] **Денисова (З. М.). On the comparative Ecology of Blood-sucking Diptera. I. The Rôle of the Crop.** [*In Russian.*]—*Zool. Zh.* **22** fasc. 4 pp. 214–221, 3 graphs, 12 refs. Moscow, 1943. (With a Summary in English.)

The following is mainly based on the author's summary. The experiments described show that a female of *Anopheles maculipennis*, Mg., is not harmed by injection into its body cavity of a small amount of distilled water, but usually suffers an osmotic shock when the amount injected is more than 50 per cent. of its body weight. Water in the body cavity or mid-intestine is wasted at a very rapid rate. In nature, however, free fluids ingested by mosquitos are drawn directly into the crop [*cf. R.A.E.*, B **14** 216; **18** 23], which has a water-impermeable wall and serves to control the expenditure of ingested water and the concentration of the haemolymph. This function of the crop is characteristic of all blood-sucking Diptera, except such specialised forms as *Glossina* [*cf.* **16** 259] and the Pupipara.

Gasperini (G. C.). **La fauna anofelica della Piana di Selaclacà (Tigrai Orientale).** [The Anopheline Fauna of the Plain of Selaclacà.]—*Boll. Soc. ital. Med.* (*Sez. Eritrea*) **1** no. 2 pp. 105–106. Asmara, 1942. (With a Summary in English.) [Recd. 1944.]

A description is given of the Plain of Selaclacà in eastern Tigré, Abyssinia, where a large leprosy institute was set up in 1938–39. The property is bounded on the north by an almost perennial stream, and within it are many large holes that hold water during the dry season and also a spring. Larvae of four species of *Anopheles* were taken during 1939 in the course of constructional work at the institute. *A. cinereus*, Theo., was the most frequently found and occurred in both the wet and dry seasons. *A. garnhami*, Edw., was sometimes associated with it, but was found only in the dry season in the water holes. *A. christyi*, Newst. & Cart., and *A. coustani*, Lav., were found only in the rainy season (June-October). The former showed a preference for temporary foci near the spring, while the latter was limited to the stream bordering the estate.

Deane (L. M.), Deane (M. P.) & Causey (O. R.). **Descrição do ovo, larva e pupa de** *Anopheles* (*Arthuromyia*) *gilesi* **(Neiva, 1908).**—*Papéis avulsos Dep. Zool.* **3** no. 10 pp. 167–181, 29 figs., 4 refs. São Paulo, 1943.

Detailed descriptions are given for the first time of the egg, larva and pupa of *Anopheles gilesi*, Neiva, 153 females (ten of which oviposited) and larvae from which adults of both sexes were reared having been taken in a wooded and mountainous region of the State of Ceará, Brazil. Females were taken, at dusk only, in July and August 1941 and were attracted equally to man and horse. None was found in any of the 16 dwellings examined. Larvae were found in three out of 81 potential breeding places searched in July. These were small, shaded collections of fresh, clear, cold, running water containing some organic matter. *A. argyritarsis*, R.-D., and *A. kompi*, Edw., were present in the less shaded parts of two of them.

A. gilesi is the type of the subgenus *Arthuromyia* [*R.A.E.*, B **30** 109], and the characters of the larva and most of those of the pupa conform with those described for this subgenus from a study of *A. vargasi*, Gabaldon, Cova-García & López [**30** 186–187]. The validity of the subgenus is thus confirmed. The principal characters distinguishing the immature stages of the two species are given.

Ortiz C. (I.). *Simulium quadrivittatum* **Loew. Su presencia en Venezuela.**—*Bol. Lab. Clín. Luis Razetti* **4** no. 14 pp. 243–246, 10 refs. Caracas, 1944.

A list is given of the 19 species of *Simulium* that have been found in Venezuela, showing the districts in which they were taken and the authorities for the records.

They include *S. quadrivittatum*, Lw., which was found there for the first time by the author and attacked man and donkeys.

ORTIZ C. (I.). **Contribución al estudio de la entomología médica del Estado Falcón.**—*Bol. Lab. Clín. Luis Razetti* **4** no. 14 pp. 247–251. Caracas, 1944.

A list is given of 4 Triatomids, 14 mosquitos, 5 species of *Phlebotomus* and 7 other blood-sucking Diptera taken in Falcon State, Venezuela, with notes on their actual or possible relation to disease in Venezuela or other countries. The Triatomids include *Triatoma* (*Eutriatoma*) *maculata*, Erichs., and *Rhodnius prolixus*, Stål, both of which were taken in houses and had a high rate of infection with *Trypanosoma cruzi*. Among the mosquitos are *Aëdes aegypti*, L., the vector of yellow fever, *Haemagogus celeste*, Dyar & N. Tov., which is stated possibly to maintain the rural form of the disease, and *Culex fatigans*, Wied., which transmits *Filaria bancrofti* in Venezuela.

PIFANO C. (F.). **Notas sobre entomología médica venezolana. I. Flebotomos transmisores de leishmaniasis tegumentaria en el valle del Yaracuy.** [Notes on medical Entomology in Venezuela. I. *Phlebotomus* as Vectors of dermal Leishmaniasis in the Yaracuy Valley.]—*Bol. Ent. venezolana* **2** no. 2 pp. 99–102, 2 refs. Caracas, 1943. (With a Summary in English.)

Investigations on dermal and mucocutaneous leishmaniasis attributed to *Leishmania brasiliensis* were made during the years 1936–40 in a part of the State of Yaracuy, Venezuela, where the infection occurs frequently in man under various forms in the rural areas, and is also found in dogs. The endemic zone is very damp during the rainy season, when it is subject to floods, and the vegetation is luxuriant. Adults of *Phlebotomus longipalpis*, Lutz & Neiva, *P. migonei*, França, *P. intermedius*, Lutz & Neiva, and *P. davisi*, Root, were taken in dwellings feeding on persons with leishmania lesions, and *P. migonei* was also taken on dog. *P. maracayensis*, N. Tov., was found in a fowl house. Descriptions are given of flagellates found in *P. migonei*, *P. longipalpis* and *P. davisi*, and morphologically identical with the culture forms of *L. brasiliensis* from mucocutaneous lesions.

PAPERS NOTICED BY TITLE ONLY.

LANE (J.) & VULCANO (M. A.). **A armadura bucal dos simuliídeos e seu valor taxonômico (Diptera, Simuliidae).** [The buccal Armature of Simuliids and its taxonomic Value (in the identification of females).]—*Rev. Ent.* **14** fasc. 3 pp. 430–440, 28 figs., 6 refs. Rio de Janeiro, 1943.

ANDUZE (P. J.). **Sobre la fauna culicidiana de Venezuela. Descripción del huevo** [egg] **del** *Anopheles* (*Kerteszia*) *homunculus* **Komp (Diptera: Culicidae).**—*Rev. Sanid. Asist. soc.* **7** no. 3 pp. 433–434, 1 fig., 1 ref. Caracas, 1942. [Recd. 1944.]

LEGWEN (W. A.). **Transit-Plane Table Topographic Mapping used for Malaria Control Drainage.**—*J. nat. Malar. Soc.* **2** no. 2 pp. 65–70, 3 figs., 1 ref. Tallahassee, Fla., 1943.

MANI (M. S.). **Studies on Indian parasitic Hymenoptera. I.** [including *Ixodiphagus mysorensis*, sp. n., from a cattle tick, *Ornithodoros* sp.]—*Indian J. Ent.* **3** pt. 1 pp. 25–36, 6 figs., 10 refs. New Delhi, 1941. [Recd. 1944.]

SEN (S. K.). **A Method of cutting Sections of Ticks and Insects.**—*Indian J. Ent.* **3** pt. 1 pp. 51–54, 15 refs. New Delhi, 1941. [Recd. 1944.]

SPRAGUE (V.) & RAMSEY (J.). **A preliminary Note on** *Plistophora kudoi* **n. sp., a microsporidian Parasite of the Cockroach.** (Abstract.)—*Anat. Rec.* **81** Suppl. pp. 132–133. Philadelphia, Pa., 1941. [Recd. 1944.] [*Cf. R.A.E.*, B **31** 135.]

Soper (F. L.), Wilson (D. B.), Lima (S.) & Sá Antunes (W.). **The Organization of permanent Nation-wide anti-*Aëdes aegypti* Measures in Brazil.**—11¼ × 8¼ ins. [xiv+] 137 pp., 27 figs., 10 refs. New York, N.Y., Rockefeller Foundation, 1943.

This report on the organisation set up in Brazil for the control of *Aëdes aegypti*, L. [*R.A.E.*, B **31** 214–215, etc.] is based on the work carried out between 1929 and 1940 by the Co-operative Yellow Fever Service maintained jointly by the Brazilian Government and the International Health Division of the Rockefeller Foundation and represents the situation as it was in 1940 when the Government assumed entire responsibility for the programme. Its declared aim was then the eradication of *A. aegypti* from the country. After a brief historical introduction, the technique of the work is described in great detail. A translation of the instructions for inspectors is given, and the various forms used are reproduced. Details are also given of the routine organisation of work in urban areas. The town is first divided into zones, of such a size that an inspector can visit all houses, etc., in one in a week ; and 5–6 zones are grouped into a district. The qualities desirable in a zone inspector, who is responsible to a district inspector, and the duties of a general inspector are outlined. The routine inspection is then discussed, and the uses of the *aegypti* house or larval index as a means of following the progress of control measures in a certain place over a period and roughly comparing situations in different areas, and of water-container indices are explained. The circumstances in which oiling is carried out and the methods used are indicated. The lengthening of the inspection cycle when the index is reduced to a very low level is discussed.

Under the heading of complementary services in urban areas, accounts are given of the services that deal with the introductions of larvivorous fish into large, easily accessible containers where they can become self-sustaining and other methods cannot be used, with the proofing of tanks that are difficult of access, with the control of breeding in flower vases in cemeteries, with cleaning ditches and waste land in cases of emergency, with oiling and with the inspection of vacant houses. Special services are then dealt with in some detail. These are the Maritime Service, which is responsible for eliminating so far as possible all breeding in port areas and on ships in port, the River Service, which is responsible for the inspection of river craft, the Producing Focus Service, which has the special task of searching for hidden pupal foci, in the first instance on the basis of a knowledge of the situation of secondary larval foci reported by the zone inspector, and the Adult Capture Service. As zones were cleared and secondary foci became scarce, the work of the Producing Focus Service was not successful until the Adult Capture Service was instituted to provide evidence of infestation.

Further sections of the book deal with the organisation of measures against *A. aegypti* in the interior of Brazil (which is essentially the same as that of the cities except that there is less need for complementary services), with summary reports, maps and charts, and with the legal enforcement of the Service's regulations. The decree of 23rd May 1932 approving the regulations of the Service for the prevention of yellow fever in Brazil is translated in an appendix.

Cooley (R. A.) & Kohls (G. M.). **The Argasidae of North America, Central America and Cuba.**—*Monogr. Amer. Midl. Nat.* no. 1, 9¼ × 6¼ ins. [v+] 152 pp., 14 pls., 57 figs., 5 pp. refs. Notre Dame, Ind., Univ. Notre Dame, 1944.

The family Argasidae is defined, the status of the genera into which it has been divided is discussed and keys are given to separate *Argas*, *Otobius*, *Ornithodoros* and *Antricola*, these being the ones that the authors recognise as valid, and to the species of each that occur in North or Central America or Cuba.

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These species are described, reference is made to their original descriptions and sometimes to other works on them and their synonyms, if any, and notes are given on their distribution and hosts or habitat. The morphology of *Ornithodoros turicata*, Dugès, and *O. parkeri*, Cooley, is compared. There is a glossary of the terms used in describing Argasids, and diagrams showing the principal characters and notes on the methods of keeping individuals in captivity and of studying specimens are given. A classified list of hosts is appended and also a list of the Argasids found in Canada, the United States, Mexico, Guatemala, Panama and Cuba, with indications of their distribution within these countries. The New World distribution of the species of *Ornithodoros* known to transmit relapsing-fever spirochaetes is shown, and there are also very brief notes on other species known or thought to be of medical or veterinary importance.

MELLANBY (K.). **The Incidence of Head Lice in England after four Years of War.** —*Med. Offr* **70** pp. 205–206, 1 graph, 1 ref. London, 1943.

The results of a survey of the incidence of head lice [*Pediculus humanus capitis*, Deg.] among patients in hospitals for infectious diseases in industrial areas of England during the four years ended on 3rd September 1943 are given in a graph and discussed. The conditions of the survey were comparable with those of one made soon after the outbreak of war [*R.A.E.*, B **29** 99], and it was made in the same hospitals. The results showed that little change in the prevalence of infestation had occurred during the four years of war, what slight alteration there was being for the better, except among women and girls over 14, who showed an increase.

[LEVKOVICH (E. N.).] **Левкович (Е. Н.). Active Immunization against European Spotted Typhus. Communication I. Adaptation of the Virus of the European Spotted Typhus to the Organism of white Mice.** [*In Russian.*]—*Zh. Mikrobiol.* 1943 no. 1–2 pp. 33–36, refs. Moscow, 1943.

[LEVKOVICH (E. N.) & PETRISHCHEVA (P. A.).] **Левкович (Е. Н.) и Петрищева (П. А.). Communication II. Comparative Valuation of the Effectiveness of Spotted-typhus Vaccines in Experiments on Animals and in epidemiological Tests on Man.** [*In Russian.*]—*T.c.* pp. 36–43, refs.

Durand & Sparrow found that prolific multiplication of the rickettsiae of Marseilles fever or murine or epidemic typhus took place in the lungs of white mice that had been infected intranasally, and Durand & Giroud successfully used such infected lungs for the preparation of typhus vaccine. These results were confirmed by the experiments described in the first paper in which characteristic pneumonia infection, with a large accumulation of *Rickettsia prowazeki*, was produced in white mice by intranasal injection of a centrifuged emulsion of the intestines of lice [*Pediculus humanus*, L.] that had fed on typhus patients, and was subsequently maintained in further mice by similar injection of lung-tissue emulsion. The virulence of the infection was increased by serial passage.

In the second paper the results are given of tests on guineapigs and man of the protection against epidemic typhus afforded by Cox's vaccine (prepared from *R. prowazeki* cultivated in the tissue of the yoke sack of a chick embryo), a vaccine made from infected mouse lung and vaccines prepared by two slightly different methods from the intestines or whole bodies of infected lice. All were efficient, and there was no evidence that one was preferable to another, except that the vaccine prepared from the whole bodies of lice was less satisfactory, as it caused an allergic skin reaction in two instances.

Details are given of the method adopted for rearing the lice in large numbers in order to obtain vaccine from them. They were kept at 30–32°C. [86–89·6°F.] and 85–90 per cent. humidity in small wooden boxes ($4 \times 2\frac{1}{2} \times 10$ cm.) with

tightly fitting lids and with bottoms of bolting silk. A piece of muslin folded double was placed over the lice in each container, which would hold 100–150 large adults or twice as many larvae. The lice were allowed to feed for an hour twice daily by strapping the boxes round the hips of women who were immune from typhus. Uninfected lice were not fed on the same woman as infected ones, so that they could not become infected by feeding on the excreta of the latter. Feeding once daily instead of twice reduced the numbers of eggs laid per female from 230–300 to 160–200 and resulted in high mortality of the young lice, which became too weak to suck blood if starved for 15–20 hours after hatching.

The lice usually settled and oviposited on the muslin that covered them. The muslin was renewed weekly when the boxes were cleaned and the old pieces with the eggs were put in fresh ones. Under the conditions of rearing, the rate of mortality was only 2–10 per cent. in the egg stage and 25–35 per cent. during subsequent development, and the life-cycle averaged 19 days. The eggs hatched in 6–7 days. The extremes of temperature at which hatching occurred [*cf.* *R.A.E.*, B **30** 21] were 22–23 and 38°C. [71·6–73·4 and 100·4°F.]; practically all newly laid eggs lost their viability in 3–5 days at temperatures below 23°C.

The lice were infected by Weigl's method of rectal injection [*cf.* **31** 45] or by feeding them on typhus patients during the first 4–6 days of illness, the latter method resulting in the infection of about 50 per cent. They were given three or four feeds of an hour's duration on the typhus patients in the course of two or three days, and were then fed on healthy women as before, since, if they were fed on a patient after the sixth day of illness the rickettsiae did not accumulate in them and frequently did not develop at all, being apparently neutralised by the substances that appeared in the patient's blood. A third method of infecting lice, developed by Pshenichnov but not used by the authors, consists in allowing them to feed on the skin of an immune person after it has been smeared with an emulsion of infective material [*cf.* **27** 241]. The temperature and humidity at which the lice were normally reared proved most favourable for the development of rickettsiae in them. The rickettsiae appeared and attained their maximum numbers 5–7 and 14–16 days, respectively, after the lice were fed on the patients.

[Pshenichnov (A. V.).] **Пшеничнов (А. В.). A universal Method for Studying Infections transmitted to Man by Blood-sucking Insects and a new Vaccine against Spotted Typhus.** [*In Russian.*]—*Zh. Mikrobiol.* 1943 no. 1–2 pp. 43–48, refs. Moscow, 1943.

The author and his collaborators have devised a method of infecting lice [*Pediculus humanus*, L.] with typhus in large numbers by allowing them to feed through a piece of animal membrane on defibrinated human blood to which has been added an emulsion of infected louse intestine or guineapig brain. The appearance of *Rickettsia prowazeki* in the lice usually occurred after 7–9 days. The blood is warmed to about the temperature of the human body and is kept at slight pressure under the membrane. This method of feeding has also been successfully used by Mitrofanova to infect lice with bacteria, and preliminary work has shown that other blood-sucking insects, and even ticks, will take blood through membranes.

The advantages of infecting the lice in this way over Weigl's method of rectal injection include the avoidance of injury to the lice, the ease with which large numbers can be infected and the fact that immature lice, as well as adults, can be used. A typhus vaccine as effective as that of Weigl was prepared from third-instar lice that had received their infecting feed when they were newly hatched and were then fed once a day on man for 9–10 days. Weigl's vaccine can only be obtained by feeding lice on man twice a day for about a month.

In preliminary experiments, lice were reared from egg to adult when fed exclusively through membranes. In this case, citrated blood proved better than defibrinated blood. In comparison with lice fed on man, however, the duration of development was rather longer, the rate of mortality during moulting was higher, and the surviving females laid fewer viable eggs.

[Raĭkher (B. I.).] **Райхер (Б. И.). Fundamental Principles of the Technique of preparing Vaccine against Spotted Typhus from Intestines of Lice by Pshenichnov-Raĭkher's Method.** [*In Russian.*]—*Zh. Mikrobiol.* 1943 no. 1–2 pp. 48–51, refs. Moscow, 1943.

Details are given of the technique used to prepare a typhus vaccine from third-instar lice [*Pediculus humanus*, L.] infected in the first instar by feeding through a membrane [see preceding paper], with notes on the method of feeding the lice and of obtaining a constant daily supply of them. For the latter purpose, adults were kept at 30°C. [86°F.] and a relative humidity of 70–80 per cent. in glass jars containing chopped human hair, and were allowed to feed on man for 30 minutes twice a day. A ratio of 1 male to 4 females secured maximum oviposition and hatching of 96·4 per cent. of the eggs. The hairs with the eggs on them were daily transferred to other jars and hatched in about five days. The newly hatched lice were collected by allowing them to crawl on to small pieces of fabric that had been rubbed against human skin, to which they were attracted by the odour of perspiration.

The infective blood on which the lice were fed was in a small metal box over which a membrane was stretched and held in position by means of a ring. They attached themselves quickly when scattered over the membrane and completed their feed in 15–120 minutes, the time varying with the quality of the membrane employed. Up to 1,500 could be infected simultaneously on each feeding box, and the blood in a box remained infective for at least 24 hours. After infection, they were fed on man once a day. More frequent feeding did not affect the time of appearance or the intensity of the development of the rickettsiae, though it somewhat reduced the rate of mortality among the lice. With one daily feed, however, the rate of mortality did not exceed 30 per cent. during the 10–14 days required for the appearance of the rickettsiae.

[Korshunova (O. S.).] **Коршунова (О. С.). Etiology of Tick Spotted Typhus in Krasnoyarsk Province.** [*In Russian.*]—*Zh. Mikrobiol.* 1943 no. 1–2 pp. 59–64, 7 graphs, refs. Moscow, 1943.

[Krontovskaya (M. K.) & Shmatikov (M. D.).] **Кронтовская (М. К.) и Шматиков (М. Д.). On the Epidemiology of the Tick Spotted Typhus of central Siberia.** [*In Russian.*]—*T.c.* pp. 65–68, refs.

[Bocharova (T. V.).] **Бочарова (Т. В.). On the Epidemiology of the Tick Spotted Typhus.** [*In Russian.*]—*T.c.* pp. 68–72, 1 graph, refs.

In the first paper an account is given of investigations on the causal agent of a disease transmitted by *Dermacentor nuttalli*, Olen. [*cf. R.A.E.*, B **27** 240], epidemics of which occurred in spring and summer in the Province of Krasnoyarsk (central Siberia). It is called tick-typhus, since its symptoms were similar to those of epidemic typhus. It proved to be pathogenic to guineapigs, rabbits and monkeys, but not to white rats. Rickettsiae were observed in the tunica exudate of the guineapigs, and the rabbits and monkeys gave a positive Weil-Felix reaction, which was most marked with Proteus OX19. Cross-immunity tests demonstrated the identity of the strains of the causal agent isolated from different patients, from examples of *D. nuttalli* collected in a focus of the disease, and from ground-squirrels [*Citellus*]. A strain from man immunised guineapigs against Marseilles fever, but not against a guineapig

strain of epidemic typhus. On the other hand, the last strain conferred almost complete immunity from the tick-typhus strain, while Marseilles fever conferred none.

Much of the information in the second paper is similar to that already noticed [*loc. cit.*]. Investigations in central Siberia revealed a focus of tick-typhus of three years' standing in a steppe district where *D. nuttalli* was practically the only tick found. It occurred in areas overgrown with grasses, the adults were abundant on cattle, and numerous larvae were taken early in July on *Citellus eversmani* and *Stenocranius* (*Microtus*) *gregalis*. The other ticks found were *D. silvarum*, Olen., and *Ixodes persulcatus*, Schulze, but they occurred in negligible numbers, and *I. persulcatus* was confined to places covered with woody vegetation, where the adults were taken on cattle, horses, dogs and cats. Natural infection was found to be prevalent in *D. nuttalli*, and guineapigs contracted the disease when the ticks were fed on them. Possible measures for the control of ticks are discussed. They include the burning or mowing of grass, the application of sprays, the dipping of cattle and measures directed against the rodent hosts.

In the third paper is recorded the finding of several foci of tick-typhus in eastern Siberia where areas overgrown with low woody vegetation or tall and dense grass provided favourable conditions for ticks and rodents. All the infected persons had been bitten by ticks, and the numbers of cases were greatest in localities in which ticks were most abundant. Natural infection was demonstrated in *Eutamias asiaticus*, *Cricetulus furunculus*, *Microtus michnoi*, *Apodemus agrarius* and the house rat, *Mus* (*Rattus*) *norvegicus*, and also in a large proportion of larvae of ticks on rodents and of adults on cows and dogs. The infection in larvae suggests that the causal agent persists in ticks from one generation to the next, and this view is supported by experiments by workers in central Siberia in which guineapigs were infected by inoculation of eggs laid by ticks taken in the field, and also by the bites of the larvae and nymphs of ticks, including *D. nuttalli*, *D. silvarum* and *Haemaphysalis concinna*, Koch. Suggestions similar to those in the second paper are made for tick control.

VARGAS (L.). **Nuevos datos sobre simulidos mexicanos (Dipt. Simulidae).** [New Data on Mexican Simuliids.]—*Rev. Inst. Salub. Enferm. trop.* **4** no. 4 pp. 359–370, 43 figs. Mexico, D.F., 1943. (With a Summary in English.)

The female of *Simulium* (*Eusimulium*) *donovani*, sp. n., and the male and pupa of *S. mathesoni*, sp. n., are described from material from the States of Chiapas and Morelos, respectively. The cocoons of *S. callidum*, Dyar & Shann., *S. mexicanum*, Bellardi, and *S. virgatum*, Coq., and respiratory filaments of *S. virgatum*, the respiratory filaments, pupa, male legs, female legs with claw and male terminalia of *S. trivittatum*, Mall., and *S. exiguum*, Roub., and the respiratory filaments, pupa, male legs and terminalia of *S. pulverulentum*, Knab, are figured for the first time.

VOGELSANG (E. G.) & LLAMOZAS GONZÁLEZ (P.). **Contribución al estudio de la parasitología animal en Venezuela. XIV. Gastrofilos de los equinos de Venezuela.** [*Gastrophilus* in Horses in Venezuela.]—*Bol. Ent. venezolana* **2** no. 3 pp. 145–148, 11 refs. Caracas, 1943. (With a Summary in English.)

Oestrids of the genus *Gastrophilus* were unknown in Venezuela until infested horses were imported into the district of Maracay (State of Aragua) in 1936–38, but they now appear to be established in this district. The larvae were found in ten native horses examined *post-mortem* between October 1938 and December 1942. One was infested by *G. haemorrhoidalis*, L., four by *G. nasalis*, L., four

by *G. intestinalis*, Deg., and one by both the last two species. Records of *Gastrophilus* spp. in Argentina, Brazil and the United States are briefly reviewed.

ANDUZE (P. J.). **Estudios de entomología médica en el Estado Mérida (Venezuela).** —*Bol. Ent. venezolana* **2** no. 3 pp. 149–156. Caracas, 1943. (With a Summary in English.)

The results are discussed of investigations made in one district of the State of Merida, Venezuela, in September 1942 and in two others in August–September 1943 on diseases known or thought to be transmitted by Arthropods. They include malaria, which was first recorded in the State in 1926 and is spreading up the valleys from the lowlands as clearing progresses. The malarious zone is almost entirely rural. There is no indigenous malaria in towns situated above 3,100 ft., but nearly all the inhabitants of the lowlands have had the disease. The wet season is not well defined, and consequently there is no regular Anopheline or malaria season. *Anopheles argyritarsis*, R.-D., *A. eiseni*, Coq., *A. neomaculipalpus*, Curry, *A. pseudopunctipennis*, Theo., *A. strodei*, Root, and *A. oswaldoi*, Peryassú, were found at altitudes of up to 1,600 ft., the first four also at 1,600–3,300 ft., and *A. argyritarsis*, *A. pseudopunctipennis* and *A. boliviensis*, Theo., at 3,300–8,200 ft. *A. eiseni* was observed attacking man for the first time. Except *A. strodei*, *A. oswaldoi* and *A. boliviensis*, the species taken are not considered as malaria vectors in Venezuela. However, in the absence of *A. albimanus*, Wied., and *A. darlingi*, Root [*cf. R.A.E.*, B **30** 190], some of the species found must transmit the disease in the district. The catches included a large proportion of *A. oswaldoi*.

Relapsing fever is endemic in some parts at between 1,600 and 5,000 ft. and occurs cyclically. The vector, *Ornithodoros rudis*, Karsch (*venezuelensis*, Brumpt), is widely distributed. The cause of an epidemic that occurred in Tovar district in 1941, causing 37 per cent. mortality, and which might have been dengue or typhus, was investigated. *Aëdes aegypti*, L., was found in urban areas, and *A. argyrites*, Dyar & N. Tov., and females of two other species of *Aëdes* were taken in rural areas, but the disease was unlikely to have been dengue, in view of the high mortality and high altitude. Weil-Felix tests on 17 survivors gave negative results for OX19. However, it is possible that the rickettsia was one that does not agglutinate the Proteus used or that the failure to agglutinate was due to the lapse of time between the epidemic and the test. The possible vectors of a rickettsia disease were *Pediculus humanus*, L. (*corporis*, Deg.), *P. h. capitis*, Deg., and *Amblyomma cayennense*, F. *Cimex hemipterus*, F., and *Ornithodoros rudis* were abundant. The B-R [Briceño Rossi] rural test usually gave doubtful results, but was sometimes clearly positive ; relapsing fever is endemic in the district, and Manson-Bahr has described a form with symptoms that agree with those of the disease under consideration and which had a mortality rate of 6 per cent.

Carate is undoubtedly present, and all infected persons examined gave positive reactions in the B-R test. In view of the suggestion that Simuliids are the vectors [*cf.* **32** 125], many were caught ; they included *Simulium lutzianum*, Pinto, *S. paraguayense*, Schrottky, *S. metallicum*, Bellardi, *S. bicoloratum*, Mall., and two species not yet determined. The limit of altitude for Simuliids appeared to be 7,500 ft. Yaws is widely distributed in some sectors of the district of Tovar. The B-R test again helped identification. Numerous Chloropids were collected, some of which are probably vectors of the disease.

It cannot be definitely said that Chagas' disease [caused by *Trypanosoma cruzi*] exists in Merida, but one patient had some of the symptoms. Two nymphs of *Rhodnius prolixus*, Stål, out of many of these bugs examined, had unidentified flagellates in the intestines. Cutaneous leishmaniasis is fairly common in the region of Estanques, and cases of the muco-cutaneous form sometimes occur.

Sandflies (*Phlebotomus*) were found from the plains up to nearly 5,000 ft. and were abundant in some places.

Anduze (P. J.). **Estudios de entomología médica en el Estado Mérida—Venezuela. La fauna culicidiana.—Descripción del** *Culex* (*Culex*) *albertoi* **sp. n.**—*Bol. Ent. venezolana* **2** no. 4 pp. 189–196, 1 fig., 8 refs. Caracas, 1943. (With a Summary in English.)

A list is given of 33 species of mosquitos, including 7 Anophelines [see preceding abstract], taken in the State of Merida, Venezuela, on the northern slopes of the Andes at altitudes of 600–13,000 ft. *Culex albertoi*, sp. n., is described from one male.

Pereira Barreto [Barretto] (M.). **Contribuição para o conhecimento dos flebótomos de São Paulo. IX. Anomalias observadas na terminalia do macho do** *P. alphabeticus* **Fonseca 1936 e de algumas outras espécies (Diptera, Psychodidae).** [Contribution to the Knowledge of the *Phlebotomus* of São Paulo. Anomalies observed in the male Terminalia of *P. alphabeticus* and of some other Species.]—*Rev. med.-cirurg. Brasil* **51** no. 12 pp. 703–710, 8 figs. Rio de Janeiro, 1943. (With a Summary in English.)

Descriptions and figures are given of abnormalities observed in the male terminalia of *Phlebotomus fischeri*, Pinto, *P. mangabeirai*, Barretto & Coutinho, *P. ayrozai*, Barretto & Coutinho, and *P. alphabeticus*, Fonseca. In the case of the last-named species, the abnormal form was described as the allotype [*R.A.E.*, B **30** 128].

Sher Khan. **A Note on the Habits of** *Eretes sticticus* **L., a Predator on Mosquito Larvae.**—*Indian J. Ent.* **4** pt. 1 pp. 90–91. New Delhi, 1942. [Recd. 1944.]

Observations at Delhi showed that adults of the Dytiscid, *Eretes sticticus*, L., occur in large numbers in stagnant water at the onset of the monsoon and lay their eggs singly in mud beneath the water, covering them with a foamy secretion. The egg, larval and pupal stages last, respectively, 3, 8–12 and 4–6 days in August. The larvae, which are very active when newly hatched, are predacious on mosquito larvae; a single individual destroys 350–400 during its development and as many as 100 in 24 hours when it is full-grown. Pupation takes place in a smooth cavity about three inches from the soil surface at the side of the pond.

Subrahmanyam (T. V.). *Acorus calamus*—**the Sweet-flag—a new indigenous Insecticide for the Household.**—*Indian J. Ent.* **4** pt. 2 p. 238. New Delhi, 1942. [Recd. 1944.]

Dried and powdered rhizomes of *Acorus calamus* [*cf. R.A.E.*, B **31** 127; **32** 7] have given encouraging results at Coimbatore against Mallophaga on fowls and against bed-bugs [*Cimex*]. Infested fowls dusted with the powder harboured no living lice next day. Dusted bed-bugs died in the course of two or three days, and although their eggs were not affected, the nymphs died within a few hours of hatching.

Robinson (G. G.). **Testing Insecticides on the Argasid Tick,** *Ornithodorus moubata*, **Murray.**—*Bull. ent. Res.* **35** pt. 2 pp. 95–99, 4 refs. London, 1944.

The results of experiments carried out over a period of three years on the toxicity of a large number of sprays and dusts to *Ornithodoros moubata*, Murr.,

are shown in tables. Accounts of the response of the Argasid to pyrethrum and rotenone have already been noticed [*R.A.E.*, B **31** 66, 67]. The following is substantially the author's summary. Both among the sprays and the dusts, those containing pyrethrum were outstanding in toxicity. If pyrethrum powder is to be used in practice, however, tests should be carried out beforehand to make sure that the sample is a good one, and as it is likely to deteriorate rather rapidly in the field, other dusts were considered. Certain derivatives of phenol and naphthalene were active as fumigants. Although they would evaporate quickly in contact with the general atmosphere, they might have some use as soil-fumigants in the floors of African huts. Other derivatives, such as alpha-naphthylamine and 3-methyl-6-ethylphenol, acted purely as contact poisons and yet were just too volatile to be lasting in the general atmosphere. The second is the more toxic, and it is possible that the substitution of a higher alcohol for the methyl or ethyl group would decrease the volatility but not the toxicity.

DAVID (W. A. L.). **Fumigation as a Method of controlling the Body Louse, *Pediculus humanus corporis*, De Geer. Part III. Practical Tests.**—*Bull. ent. Res.* **35** pt. 2 pp. 101–112, 3 figs., 20 refs. London, 1944.

Descriptions are given of practical experiments with simple large- and small-scale methods of controlling body lice, *Pediculus humanus humanus*, L. (*P. h. corporis*, Deg.), and their eggs, using the six fumigants selected on the basis of preliminary tests [*R.A.E.*, B **32** 135]. For small-scale treatment, the fumigant is sprinkled on to blankets, etc., as they are placed in an ash-bin [*cf.* **31** 212], and a clean article is tucked on top under the lid. The quantities in cc. per cu. ft. that gave complete control of lice and eggs, in 1, 2 and 5 hours [*cf. loc. cit.*] were : for methyl formate, 38, 27 and 19 at 10°C. [50°F.] and 27, 21·5 and 13·5 at 20°C. [68°F.] ; for ethyl formate, 30, 24 and 11 at 10°C., 24, 19 and 8 at 20°C., and 16, 11 and 8 at 30°C. [86°F.] ; for methallyl chloride, 41, 33 and 8 at 10°C., 19, 8 and 4 at 20°C., and 8, 4 and 2·75 at 30°C. ; for trichloracetonitrile, 12, 5·5 and 2·75 at 10°C., 5·5, 4 and 1·35 at 20°C., and 4, 4 and 1·35 at 30°C. ; and for chlorpicrin, 8, 8 and 1·35 at 20°C., and 4, 2·75 and 1·35 at 30°C. Chlorpicrin also gave complete control at 24 and 4 cc. per cu. ft. in 2 and 5 hours at 10°C. and ethylene dichloride at 49, 43 and 33 cc. at 10, 20 and 30°C., respectively, in 5 hours. Methods employed for estimating chemically the concentration of fumigant built up are described, and the results obtained with all except ethylene dichloride are shown, compared with the concentrations known to give complete control of eggs in one hour, and discussed. Other tests of small-scale fumigation were made with heavy woven sacks, which were found to be unreliable, and with tarpaulin sheets, in which quite good results were obtained when a bundle of blankets was laid in the middle with a dosage of fumigant about 20 per cent. in excess of that used in the bins and the sheet was folded over.

A chamber of plywood, measuring 6 by 5 by 5 ft. and having a sliding partition down the middle, was used for large-scale tests with methyl formate, ethyl formate and methallyl chloride. The compartments had separate doors, and there was a small hole near the top of each through which the hand could be inserted and which was closed by a swivelling piece of plywood while not in use. Each half held 120–150 folded blankets and was treated as a separate unit. It was loaded in a similar way to the bins, but this would have been unsafe with trichloracetonitrile or chlorpicrin, for which injection methods would have been necessary. The blankets were put in in bundles of ten, and about three-quarters of the fumigant was applied as the chamber was being filled and the remaining quarter sprinkled over the top layer through the hole after the door was shut. Complete control was effected in 2 and 5 hours by 28 and 21 cc.

methyl formate per cu. ft. at 10°C. and 28 and 18 cc. at 20°C., and the corresponding figures for ethyl formate were 28, 14, 24 and 14. Methallyl chloride gave complete control in 5 hours at 10·5 cc. and 10°C., in 2 and 5 hours at 12 and 7·5 cc. at 20°C. and in 2 hours at 10·5 cc. and 30°C. The concentration of fumigant was estimated as in the bin tests. It was greater in the middle of the bundles of blankets, 40 thicknesses from the point of application, than in the air space around the bundles. The rate of fall in concentration could be reduced by sealing the joints of the cabinet.

The disadvantages of the large-scale method are the comparatively long exposures and large quantity of fumigant needed. Its advantages are the simplicity of the chamber and the quantity of material that can be treated in a small space. The choice of fumigant and the necessary precautions are discussed. One of the formates or trichloracetonitrile should be used at temperatures below 20°C. All the fumigants are suitable at or above this temperature except that methyl formate is too volatile for use at temperatures much above 25°C. [77°F.]. No damage is known to be caused to cotton or woollen clothing.

Busvine (J. R.). **Destruction of Lice in Clothing by hot and cold Air.**—*Bull. ent. Res.* **35** pt. 2 pp. 115–125, 4 graphs, 6 refs. London, 1944.

The experiments described were undertaken with a view of using heat for the control of *Pediculus* [*humanus*, L.] in bedding in air-raid shelters in London and winter cold for their destruction in eastern Europe. The tests were made with army blankets, which were found to have a thermal insulation value intermediate between that of pure woollen ones and poor quality substitutes. The precise limits of resistance of lice and their eggs to high temperature as defined by Buxton [*R.A.E.*, B **32** 135] are set out and compared with data for *Cimex* [*lectularius*, L., and *hemipterus*, F.], *Sarcoptes* [*scabiei*, Deg.] and *Xenopsylla* [*cheopis*, Roths.] also taken from the literature. The young louse eggs used were the most resistant and are therefore good test subjects.

Small-scale trials showed that the exposures required to maintain a rapidly lethal temperature (54°C. [129·2°F.]) for five minutes under one and (in brackets) three layers of blanket were 9½ (20), 12 (25), 14 (35), 20 (58) and 50 (115) minutes at still air temperatures of 110, 92, 80, 70 and 60°C. [230, 197·6, 176, 158 and 140°F.], or 11 (25) minutes at 80°C. with a fan.

Full results are given of tests in heated rooms without forced draught, in which lice and eggs were exposed under one and three layers of blanket at floor level and at heights of 2 and 6 ft., for 30, 45, 60 and 30 minutes with air temperature at 4–5 ft. of 74, 70, 66 and 62°C. [165·2, 158, 150·8 and 143·6°F.], respectively. Treatment at 62°C. was a complete failure. The other treatments gave complete kill of eggs under one layer of blanket and of all lice at 6 ft., but complete mortality of eggs was never obtained under three layers. The results at lower levels were poor owing to layering of the hot air, which renders this method of control unreliable. Only that part of a chamber should be used in which a free air temperature of 70°C. can be obtained when the chamber is loaded, and this temperature should be maintained for an hour. In a test of the effectiveness of a routine disinfestation of bedding and clothing from an air-raid shelter in London with a portable apparatus with circulating hot air, 17 out of 20 test batches of eggs distributed in various parts of the chamber were killed by an exposure of half an hour, including some near the loading entrance where the highest temperature reached was 55°C. [131°F.]. The three other batches were in particularly inaccessible positions in a folded pillow, a folded mattress and a folded eiderdown. A gas-heated disinfesting chamber with a circulating hot air system that has been developed consists of a 30-ft. tunnel, 6 ft. by 6 ft. in cross section, with doors at the ends. The bedding to be treated is placed over rods carried on cradles that hang from an endless overhead rail running through the chamber and completing the circuit outside. Five cradles can be

exposed while five are being unloaded and reloaded. Any constant temperature up to 260°F. can be maintained. In the first two tests of this apparatus carried out under unfavourable conditions in November 1943, exposure for 20 minutes to 220 or 260°F. killed all eggs except those between the touching sides of mattresses hanging over rails. In the next two trials, the mattresses were hung over two rails about nine inches apart, two blankets were hung on rods under the arch so formed and pillows were hung on hooks at one end of each mattress. Temperatures of 220 and 240°F. were maintained for 20 minutes and the only eggs that survived had about five thicknesses of blanket on each side of them.

Complete kill of lice that had previously been gradually chilled was obtained at −20, −17·5, −15, −10 and −5°C. [−4, 0·5, 5, 14 and 23°F.] in ½, 1, 2, 7½ and 20 hours, and complete kill of eggs was obtained at these temperatures in 4, 5, 10, 24 and 71 hours, respectively. Adult lice protected by three layers of blanket or one layer of a lined musquash fur coat were killed by exposure for 5 hours to an air temperature of −15°C. The eggs survived 5 hours at −20°C. and 24 hours at −15°C., but their destruction might be less important than that of the adults as the typhus rickettsia cannot be transmitted through them.

Roy (D. N.) & Ghosh (S. M.). **The Mechanism of Action of a contact Insecticide.** —*Bull. ent. Res.* **35** pt. 2 pp. 161–170, 3 figs., 11 refs. London, 1944.

The literature on the mechanism of the penetration of a contact poison into an insect is briefly reviewed. Unlike most workers, who accept the theory of the permeability of the cuticle [*R.A.E.*, B **19** 198; **30** 15; **31** 23, etc.], the authors & Chopra concluded that contact insecticides enter the tracheae through the spiracles and are then quickly eliminated into the body cavity through the tracheal wall [**31** 181]. Experiments that support the latter view are described.

When five preparations containing extracts of pyrethrum were applied with a brush, at least five times within a few seconds, only to the last two or three abdominal segments of mosquitos (*Armigeres obturbans*, Wlk.), no effect was observed. When legs of a living mosquito were kept for five minutes in a drop of the insecticidal fluid, there was no definite proof of the penetration of the pyrethrum. Transverse sections of the femur and of the abdomen after these had been treated separately with solutions containing a few drops of oleic acid failed to reveal the presence of oil globules underlying the cuticle. The death of some mosquitos that succumbed during treatment of the last abdominal segments was attributed to the insecticide running along the body surface and reaching the inside of the tracheae through the spiracles. This view was substantiated by the finding of droplets of oil inside the tracheae or outside them in the thoracic cavity. Sections of the abdomen of these mosquitos, on which the insecticide was directly applied, failed to show the presence of oil. Application of a mixture of kerosene and pyrethrum to the dorsum of the thorax of *Pediculus humanus capitis*, Deg., for 5–10 minutes produced no signs of paralysis.

Additional evidence that pyrethrum normally enters through the spiracles was afforded by releasing mosquitos in a chamber into which a mixture of petroleum ether containing pyrethrins and oleic acid had just been sprayed. In frozen sections, droplets of oil were invariably found in intimate association with the tracheae, either inside or outside them or both. The petroleum ether holding the oil in solution quickly escapes through the wall of the trachea by diffusion, hence its appearance just outside it. As fat droplets occur under nearly the whole of the cuticle of the dorsal part of the thorax in normal mosquitos, the detection of oil globules underlying the cuticle of the dorsum of the thorax cannot be taken as evidence of the passage of the insecticide through the cuticle. When an insect had been allowed to take in the maximum amount of insecticide, most of the oil was deposited just outside the large tracheal trunks and fewer droplets inside them; the small branches sometimes contained

oil, but there was seldom any outside them. When the dosage was small, the oil was found only outside the large trunks. These facts indicate that the petroleum ether carrying the insecticide in solution quickly diffuses out through the tracheal wall and that the accumulation of oil inside the trachea occurs only when the power of diffusion is lost. When mosquitos were subjected to the action of oleic acid alone in a testing chamber, few were killed and sections of the thorax did not show any differences from a normal mosquito in the disposition of the oil droplets. This proves that the fine droplets of oleic acid discharged from a De Vilbiss spray cannot enter the tracheae.

Data are given on experiments made with ticks and flies (*Chrysomyia megacephala*, F.) that provided supporting evidence that pyrethrum enters through the spiracles only and that there is no difference between the method of penetration of a powder and the liquid into the body. The flies were protected from poisoning by the sprays or dusts when their spiracles were sealed with paraffin wax ; and the atracheate larvae of *Ornithodoros savignyi*, Aud., were not affected by 24 hours' contact with a pyrethrum dust or 6 minutes' immersion in kerosene containing 0·12 per cent. pyrethrins, whereas nymphs and adults of *O. savignyi* and adults of *Rhipicephalus sanguineus*, Latr., died in 24 hours after immersion for 2–60 seconds in the liquid, and nymphs and adults of the former were quickly affected by the dust. It is pointed out that all evidence of penetration of the insecticide through the cuticle, except that of Robinson [**31** 5] and Wigglesworth [**31** 23] was based on studies made especially on the dead cuticle. In Robinson's experiments, immersion of larvae of *O. moubata*, Murr., in a solution containing 0·15 per cent. by weight pyrethrin I for three hours was found not to affect them adversely. While Wigglesworth demonstrated the passage of the insecticide through the cuticle of *Rhodnius* by prolonged contact, paralysis did not ensue within two hours. It is concluded that the " normal " route of penetration of the insecticide is not through the cuticle, but through the respiratory system.

VAN EMDEN (F. I.). **A new Sub-species of *Glossina* from Uganda (Diptera).**—*Bull. ent. Res.* **35** pt. 2 pp. 193–196, 5 figs. London, 1944.

Glossina nigrofusca hopkinsi, subsp. n., is described from adults of both sexes from Uganda. The author considers that *Glossina* is divisible into two subgenera, *Glossina*, sens. str. (including *Nemorhina*, R.-D.) and *Austenina*, Towns. (including *Newsteadina*, Towns.), the latter subgenus comprising the species of the group of *G. fusca*. The characters of these subgenera are compared, and a key is given to the species of *Austenina* with long proboscis and palpi (*nigrofusca*, Newst., *fusca*, *haningtoni*, Newst. & Evans, *fuscipleuris*, Aust., and *severini*, Newst.) and the new subspecies.

DA FONSECA (J. A. B.) & MARAGLIANO jr. (L.). **Manual pratico de malária.** [Practical Malaria Manual.]—9 × 6¼ ins., 99 pp., 14 figs. (2 col.). São Paulo, Serv. Profil. Malár. Dep. Saúde, 1943.

About one-third of this handbook on malaria is devoted to the mosquito vector. The morphology of Anophelines in all stages and the digestive system of the adult are described, and their developmental cycle, the nature of their breeding places, the oviposition and feeding habits of the adults and factors influencing the development of the malaria parasites in them are outlined. Directions are given for collecting immature stages, catching adults and rearing larvae. Control of larvae by engineering, chemical, mechanical and biological methods and of adults by catching, spraying and fumigation, and protective measures are discussed in the last chapters.

[**Papers on Mosquito Control.**]—*Mosq. News* **4** no. 1 pp. 17–22. New Brunswick, N.J., 1944.

The first of these papers is " Studies on the comparative Attractiveness of 25-, 50- and 100-watt Bulbs for Puerto Rican *Anopheles*," by H. D. Pratt (pp. 17–18), in which data are given on the numbers of the three local species of *Anopheles* taken on ten nights in New Jersey light-traps [*R.A.E.*, B **31** 195, etc.] with 25-, 50- and 100-watt bulbs, operated simultaneously 150 feet apart near a swamp in Porto Rico during the autumn of 1943. The traps with 50- and 100-watt bulbs took, respectively, 2·6 and 4 times as many females of *A. albimanus*, Wied., 2·7 and 4·8 times as many of *A. vestitipennis*, D. & K., and 1·8 and 1·9 times as many of *A. grabhami*, Theo., as the one with the standard 25-watt bulb. There was considerable variation on individual nights. The number of males taken was too small to be significant.

The other paper is " References to Literature of Interest to Mosquito Control Workers," by H. H. Stage (pp. 19–22).

Yao (Y. T.). **Present Status of Malaria in Free China.**—*Chin. med. J.* **61** no. 1 pp. 38–46. Washington, D.C., 1943.

The epidemics of malaria that have occurred in China since 1923 are reviewed, and the results of surveys of endemic malaria made since Faust published the results of his enquiry in 1926 [*R.A.E.*, B **15** 25] are summarised. A list is given of 25 species and 6 varieties of *Anopheles* that have been recorded from Free China. Malaria is hyperendemic, with *Plasmodium falciparum* as the predominant type, in the south-western Provinces of Free China, especially along the borders of Indo-China, Siam and Burma. In the low flat regions, *P. vivax* predominates and the chief vector is *A. hyrcanus* var. *sinensis*, Wied. The chief vector in the south-western hilly region was found to be *A. minimus*, Theo., with *A. jeyporiensis* var. *candidiensis*, Koidz., second in importance.

Yao (Y. T.), Wu (C. C.) & Pei (Y. S.). **Some epidemiological Factors of Malaria in Mangshih, Yunnan, with Remarks on the Occurrence of Blackwater Fever.**—*Chin. med. J.* **61** no. 3 pp. 197–211, 4 refs. Washington, D.C., 1943.

The information obtained during an investigation into the epidemiology of malaria in Mangshih, Yunnan, made between June and December 1940 is reported and discussed. Mangshih is in a mild, rice-growing valley, and the rainy season usually lasts from late April to September. Malaria is highly endemic, with *Plasmodium falciparum* predominating [*cf.* *R.A.E.*, B **29** 94]. The proportion of *P. vivax* rose gradually from July to November, and the monthly malaria incidence rose from July to December. Five cases of blackwater fever were seen. It seems comparatively common in south-western Yunnan, although rare in other parts of China.

The Anophelines found comprised 16 species and two varieties, all of which have previously been recorded from Yunnan [**25** 233; **31** 215, etc.]. Among the 13 taken as adults at catching stations, the commonest were *Anopheles minimus*, Theo., *A. jeyporiensis* var. *candidiensis*, Koidz., and *A. hyrcanus* var. *sinensis*, Wied., of which the average numbers taken per survey were 24·5, 5·8 and 5, respectively. They had total infection rates of 3·3, 0·2 and 0·06 per cent. and sporozoite rates of 1·4, 0 and 0 per cent., respectively. No other species was found infected. Black spores of Ross [**29** 198] were found in one female of *A. minimus* infected with sporozoites and four infected with both sporozoites and oöcysts and in one of *A. hyrcanus* var. *sinensis* free from other infection. The numbers of adults of *A. minimus* taken increased from August to

November. It was by far the commonest species in dwellings. It is concluded that control measures should be directed chiefly against this species, which breeds mainly in ditches [**31** 216].

Chin (Ta-hsiung) & Li (Kuei-chen). **A Survey of the metazoan Parasites of the domestic Cat, *Felis domestica*, of Kweiyang.**—*Chin. med. J.* **61** no. 3 pp. 217–226, 21 refs. Washington, D.C., 1943.

Of the 120 cats examined, 72 were infested with fleas and one with Trichodectids. The fleas comprised 1,325 examples of *Ctenocephalides felis*, Bch., and one each of *Xenopsylla cheopis*, Roths., *Ceratophyllus* (*Monopsyllus*) *anisus*, Roths., and *Pulex irritans*, L. *C. anisus* is the common rat flea of China, but one of the authors had previously found that *X. cheopis* is the common species on rats in Kweiyang.

Hecht (O.). **Las pulgas de las ratas en Venezuela (nota preliminar).** [Rat Fleas in Venezuela (preliminary Note).]—*Rev. Sanid. Asist. soc.* **7** no. 6 pp. 811–820, 2 figs., 26 refs. Caracas, 1942. [Recd. 1944.]

The 3,395 fleas taken on rats in Caracas in 1939 and 1940 comprised 3,227 individuals of *Xenopsylla cheopis*, Roths., 116 of *X. brasiliensis*, Baker, 50 of *Ctenocephalides* (*Ctenocephalus*) *felis*, Bch., and 2 of *Rhopalopsyllus* sp. Those on four dogs comprised 205 individuals of *C. felis* and two of *Pulex irritans*, L. Fleas that attacked the bare legs of a boy in the north of Guarico State and one taken from a dog in the same neighbourhood were also *C. felis*. These findings are compared with data from various other parts of America. According to I. Díaz, about 98 per cent. of the rats in Caracas are *Mus* (*Rattus*) *norvegicus*, but *M.* (*R.*) *rattus* and *M.* (*R.*) *rattus alexandrinus* are also present.

The last occurrence of plague in Venezuela was in 1939-40 when there were 11 cases with eight deaths in Ricaurte District, Aragua State. The region has since been carefully watched, particularly for rodent plague. It is thinly populated and mostly wooded, and is situated on the frontier of Miranda and Aragua States at an altitude of 2,000–5,000 ft. The rodents according to Díaz are mostly wild, *M. rattus* and *M. r. alexandrinus* occasionally occurring among them. The 396 fleas examined included only one example of *X. cheopis*, seven of *X. brasiliensis*, one of *C. felis* and two of *P. irritans*, while *Rhopalopsyllus* spp. formed 97·2 per cent. of the whole. No characters were found to separate the 267 females of *Rhopalopsyllus* into species. Of the 118 males, 90 were identified as *R. bohlsi* var. *jordani*, Costa Lima, and 25 fell into a second group. In the absence of considerable numbers of other species, these two forms are probably the vectors of rodent plague in the region and possibly responsible for transmission to man. Records of species of this genus from other parts of South and Central America are given from the literature, together with discussions of the possible part they play in maintaining plague.

Anduze (P. J.). **Distribución geográfica de los *Haemagogus* venezolanos y su posible relación con la fiebre amarilla selvatica.** [Geographical Distribution of the Venezuelan Species of *Haemagogus* and their possible Relation to Jungle Yellow Fever.]—*Rev. Sanid. Asist. soc.* **7** no. 6 pp. 821–824, 2 maps, 5 refs. Caracas, 1942. [Recd. 1944.]

Yellow fever occurs sporadically in Venezuela, and blood samples taken in 1941 from children 10–15 years old showed an immunity index of 13·6 per cent. in one rural region. No typical cases have been seen in the urban part of the endemic zones for many years, although *Aëdes* (*Stegomyia*) [*aegypti*, L.] is plentiful there, but in the rural parts, which have many representatives of the

genera *Psorophora* and *Haemagogus* and subgenera of *Aëdes* other than *Stegomyia*, there were two cases in 1941 and two in 1942, in addition to the indications of immunity. Members of the genus *Haemagogus* are particularly abundant and reach the suburban areas. *H. capricorni*, Lutz, has been found infected in nature in Brazil [and Colombia (*R.A.E.*, B **27** 121 ; **32** 184)], and Komp has recently recorded natural infection in *H. equinus*, Theo., in Colombia. The most widely distributed species in Venezuela is *H. celeste*, Dyar & N. Tov., which has been found in ten States. It occurs at altitudes of less than 2,000 ft., where the climate is hot and the summer dry, but winter conditions are suited to its development. Though it has not been proved to transmit yellow fever in the endemic zone, its abundance and the readiness with which it feeds on man make it likely to do so. *H. capricorni*, which also feeds readily on man, has been found in forests of two districts of one State only. *H. equinus*, a less aggressive species, occurs in limited numbers in the milder parts of the country at altitudes of more than 2,000 ft. Another species in the forests could not be identified owing to the absence of males. It is pointed out that the area of distribution of *Haemagogus* at times overlaps zones where urban yellow fever formerly occurred.

Anduze (P. J.). **Algunos datos sobre la biología de** *Xenopsylla brasiliensis* **Baker y morfología de la larva (Siphonaptera : Pulicidae).** [Data on the Bionomics of *X. brasiliensis* and the Morphology of the Larva.]—*Rev. Sanid. Asist. soc.* **7** no. 6 pp. 825–827, 2 figs. Caracas, 1942. [Recd. 1944.]

The larva of *Xenopsylla brasiliensis*, Baker, is described from material reared from a female taken at an altitude of 5,250 ft. in the State of Miranda, Venezuela. The eggs were laid on 26th May and hatched on 31st. Pupation began on 10th June, and the first adults emerged on 12th July. The rearing technique is described.

Anduze (P. J.). **Variaciones en huevos** [eggs] **de** *Anopheles pseudopunctipennis* **Theobald.**—*Rev. Sanid. Asist. soc.* **8** no. 3 pp. 463–465, 4 figs. Caracas, 1943.

It has been suggested that female Anophelines do not oviposit in the dry season in the tropics, though they feed regularly and their ovaries may contain fully developed eggs. However, in Barinas State, Venezuela, where the dry season is very severe, the author took larvae and adults of Anophelines and other mosquitos together at this time in 1942–43, and females of several species oviposited. Little or no abnormality was observed in the eggs of most of them, but those of *Anopheles pseudopunctipennis*, Theo., showed remarkable variations. They were of four types, laid, respectively, in December, early January, late January and February. They decreased slightly in size as the dry season advanced, and the floats became progressively smaller and were completely absent from the last type. The adults that laid the eggs were identical in colour and size, and the larvae obtained were identical and typical.

Cova-García (P.). **Penetración y dispersión en Venezuela de las especies** *Anopheles* (*Nyssorhynchus*) *darlingi* **y** *Anopheles* (*Nyssorhynchus*) *albimanus*. —*Rev. Sanid. Asist. soc.* **8** no. 3 pp. 467–472, 1 map, 8 refs. Caracas, 1943.

The principal vectors of malaria in Venezuela are *Anopheles albimanus*, Wied., on the coast and *A. darlingi*, Root, inland [*cf. R.A.E.*, B **30** 190], but both have been extending their range in recent years, and *A. darlingi* has reached the coast in some places. *A. albimanus* is distributed along the whole coast and over the country adjoining Lake Maracaibo, and also occurs near Lake Valencia ; from there it is penetrating into the interior along the main highways. The

routes followed by both reveal a certain aversion from the soils of the Eocene and a marked predilection for those of the Quaternary and Recent, Miocene and Pliocene.

HECHT (O.). **Consideraciones entomológicas a la epidemiología de la peste bubónica de los roedores en Venezuela.** [Entomological Notes on the Epidemiology of Bubonic Plague in Rodents in Venezuela.]—*Rev. Sanid. Asist. soc.* **8** no. 6 pp. 1159–1162, 2 refs. Caracas, 1943. (With a Summary in English.)

Details are given of the monthly collections of fleas from rodents trapped between March 1942 and June 1943 in the sylvatic zone of Aragua State, Venezuela, referred to in a previous paper [*R.A.E.*, B **32** 229]. *Rhopalopsyllus* formed 81·9–100 per cent. of the total in each of the 14 months for which records are given except May 1942. It then constituted only 27·5 per cent., *Xenopsylla cheopis*, Roths., and *X. brasiliensis*, Baker, forming 20·3 and 52·2 per cent., respectively. The significance in relation to the transmission of plague of this occasional appearance of species of *Xenopsylla* in considerable numbers is discussed with special reference to the work of Eskey [**27** 237]. A small epidemic of plague in man (19 cases) occurred not far away in July and August 1943. The percentage of *X. brasiliensis* had risen in June to 17·3 in the whole area and to 44·9 in the nearest sector, but it was not possible to determine whether the two facts were related.

HECHT (O.). **Algunos consejos técnicos para la cría de pulgas.** [Technical Advice on the Rearing of Fleas.]—*Rev. Sanid. Asist. soc.* **8** no. 6 pp. 1163–1165, 4 refs. Caracas, 1943.

Thousands of rodent fleas (*Xenopsylla cheopis*, Roths., and *Rhopalopsyllus bohlsi* var. *jordani*, Costa Lima) have been reared on suckling mice by the method described without any having escaped. These very young animals do not eat the fleas as older ones do, the medium provided for the development of larvae does not become soiled by excreta, and food waste is eliminated. The young mice are left in the rearing receptacles for 24 hours, and others are then substituted for them and they are returned to their mother. This is easy, as there is no long fur for the fleas to hide in. Large quantities of fleas are reared in cylinders 20 cm. high and 12 cm. in diameter, and small cultures in test tubes. The bottom of the tube is covered with sand bearing food for the larvae, and the mouse is put in a wire gauze basket about one cm. above the sand. The tube is closed with a plug of cotton-wool wrapped in fine cloth. To separate the flea larvae or collect the fleas, the contents of a tube are emptied into a dish, which should stand in a receptacle containing water and of such a size that any flea that jumps from the tube during transfer will fall into the water. If it is possible that the fleas may be infected with plague or if the very active *Ctenocephalides* (*Ctenocephalus*) *felis*, Bch., is the species concerned, they should be lightly anaesthetised.

CRUTCHFIELD (C. M.) & HIXSON (H.). **Food Habits of several Species of Poultry Lice with special Reference to Blood Consumption.**—*Florida Ent.* **26** no. 4 pp. 63–66, 2 refs. Gainesville, Fla., 1943.

To determine whether blood forms a part of the normal diet of any of the Mallophaga common on fowls near Gainesville, Florida, microscopic examinations were made of the crop contents of specimens of six species, and their feeding habits were observed. Only *Eomenacanthus* (*Menacanthus*) *stramineus*, Nitzsch, and an unidentified and possibly undescribed species referred to as *Menacanthus* sp. were found to consume blood [*cf. R.A.E.*, B **21** 189]. It was detected

in most of the specimens examined and often made up a considerable portion of the crop contents, which consisted principally of barbs and barbules of feathers. There was no indication that epidermal scales were a part of the diet, but any small particle on the host might be consumed. These species obtain blood by gnawing through the epidermis of the skin and rupturing the quill of pin feathers. Their habits are similar, but *E. stramineus* is largely localised in the abdominal region, whereas the other species is not. Superficial characters are given for separating the unidentified species from *E. stramineus* and *Menopon gallinae*, L. The last-named occurs both on the skin and feathers of the host, but feeds exclusively on barbs and barbules, principally the latter. Only barbs and barbules, with a preponderance of the former, were found in the crops of specimens of *Goniocotes gigas*, Tasch., and *G. gallinae*, Retz. (*hologaster*, Nitzsch) and they were occasionally included in the diet of *Lipeurus caponis*, L., which normally fed almost entirely on the hooklets of the primary and secondary wing feathers.

DE VRIES (A. H.). **Factors influencing the Vulnerability of Merino Sheep to Blowfly Attack.**—*Fmg in S. Afr.* **18** no. 208 pp. 493–500, 7 figs. Pretoria, 1943.

The incidence of sheep blowflies is increasing in South Africa. The direct losses sustained through damage to wool, death, failure of infested sheep to breed and cost of remedies, and the indirect losses through the cost of labour required for treatment and for attending to traps and through soil erosion on account of trampling during frequent rounding up of sheep are estimated to have amounted to £1,500,000 a year. Observations on the factors contributing to susceptibility to attack have been made at Middleburg, Cape Province, over a period of five years, and the more important findings and conclusions are given in this paper. The chief cause is wetness, which penetrates to the skin and keeps it damp for some time. The ways in which it is brought about are discussed ; it usually results from poor conformation (narrowness between the aitch-bones, drooping rump or a too small bare area around the vulva), skinfolds (particularly in the immediate vicinity of the vulva), defects of the vulva arising from the two previous faults, and severe docking of the tail.

MILNE (A.). **The Ecology of the Sheep Tick, *Ixodes ricinus* L. Distribution of the Tick in Relation to Geology, Soil and Vegetation in northern England.** —*Parasitology* **35** no. 4 pp. 186–196, 1 map, 13 refs. London, 1944.

The following is based on the author's summary of the results of an investigation in the four northern counties of England. *Ixodes ricinus*, L., is the only tick that infests sheep and cattle in northern England, though *I. canisuga*, Johnston, has been found, alone or with it, on foxes and sheep dogs. Its distribution in the region is markedly discontinuous. It is practically confined to the hilly country, only about one-fifth of which is infested. In north-western Northumberland, its distribution was found to be correlated with certain factors inherent in or influenced by the surface geology. Where this is such that the natural drainage and soil are relatively good, the grazing also tends to be good, with a high proportion of sweet, nutritious grasses, and ticks are absent. Where the surface geology results in relatively poor natural drainage and soil or both, the grazing is poor (or rough), with a large proportion of rank, matted, bent-type grasses or old heather, and possibly bracken, and ticks are usually present. No consistent correlation was found between tick distribution and the pH of the soil, available phosphates and potash, soil texture, the composition of the soil as revealed by mechanical analysis, the depth of the soil,

or the quality of the natural drainage. The interaction of soil and natural drainage factors, however, profoundly influences the character of the vegetation layer.

In the four northern counties, the same plants are dominant on both infested and non-infested hill lands. Where grazing is rough (or thick), ticks are usually present irrespective of whether the dominant plant is bracken, heather or one of the rough grasses (*Agrostis*, *Nardus stricta*, *Molinia caerulea* and *Aira caespitosa*). Where grazing is relatively good, ticks are invariably absent. Observations on a smaller scale showed that the thicker the vegetation layer, the denser the tick population and also the thicker the basal mat or layer of decaying vegetation on the soil. There was a consistent positive correlation on five plots examined between mat thickness and tick population [*cf.* *R.A.E.*, B **27** 93], irrespective of whether bracken or grass was dominant. Thus the chief controlling factor in tick distribution is the physical character of the vegetation layer [*cf.* **29** 184].

Mellanby (K.). **The Development of Symptoms, parasitic Infection and Immunity in Human Scabies.**—*Parasitology* **35** no. 4 pp. 197–206, 5 figs., 9 refs. London, 1944.

It has already been shown that *Sarcoptes* [*scabiei*, Deg.] is usually transmitted by intimate personal contact [*R.A.E.*, B **29** 182; **30** 145], and varied evidence is presented that the young fertilised female mite is generally responsible for a new infestation. Attempts to effect transmission by placing eggs and larvae on the skin of uninfested volunteers failed, but attempts made by placing adult females on persons who had never before been infested were always successful, producing infestations identical with those of persons who developed scabies by sleeping with infested ones. In experiments in which volunteers slept in bedding used less than 24 hours before by persons with parasite rates (number of adult females) of 20–50, only four out of 300 became infested, but when the previous users had parasite rates of over 200, three out of ten volunteers became infested. This indicates that transmission by indirect contact is probable only when infestation is very severe. When twenty persons of whom about half were uninfested (controls) and half were infested with parasite rates of less than 50 lived together for 18 months, transmission did not occur, but when two showed rates of over 200 for a month, two cases of infestation occurred among the controls. An account is given of the fluctuations observed in the numbers of adult female mites on volunteers who had been infested for periods extending up to 265 days. They were usually infested by the direct transference of females. In all cases, a typical distribution of mites was obtained irrespective of the original site of infestation. Volunteers infested for the first time felt no irritation for about a month [**31** 86], and no evidence of erythema surrounded the region of the burrows during this period, though the mites could be detected with the aid of a lens or binocular microscope. After about a month, itching and other symptoms developed and became progressively worse for about another month. Sensitisation did not depend on the presence of large numbers of mites. In these first infestations, practically every mite that burrowed into the skin could be identified in its burrow for 5–6 weeks. Females of the second generation were never detected before the 21st day and usually not before a month had elapsed. A parasite rate of about 25 was sometimes reached in 50 days and one of more than 500 might be reached in 100 days; after this, the number of females decreased rapidly. Though this increase in mite population was not nearly so rapid as is theoretically possible [*cf.* **31** 172], it was far greater than that seen in individuals infested for the second time. In such cases, there was usually irritation and erythema within 24 hours at the sites of entry of the mites, but the mites visible at this time had often disappeared about two days later. Sometimes, the infestation did not become established. If it did,

the population generally fluctuated erratically and never attained anything approaching the proportions reached in first infestations. Analysis of the number of females in natural cases showed averages of 11·3 in 886 patients mostly infested for the first time [**31** 128] and 3·2 in 45 of the same patients in later attacks. The reason for this lies in the reaction of the skin, which is described in detail. It includes itching, which results in the mechanical removal of the mites by scratching and the production of sepsis fatal to the mites, and oedema, which renders the cuticle unsuitable for colonisation and causes the mites to vacate their burrows. These factors contribute to cause partial immunity, which may account for fluctuations in the incidence of scabies. When extract of *Sarcoptes* was injected intradermally into volunteers, there was no reaction in those who had never had scabies or who had first had it less than three months earlier, but a marked reaction in those who had had it more than six months before. This indicates that in clinical scabies, antibody formation takes place but that production is slow.

Bartley (W. C.) & Mellanby (K.). **The Parasitology of Human Scabies (Women and Children).**—*Parasitology* **35** no. 4 pp. 207–208, 3 figs., 1 ref. London, 1944.

The average number of adult females of *Sarcoptes* [*scabiei*, Deg.] per case in 119 infested women was found to be 12·5 ; 48·7 per cent. of the women had less than six and only 5·9 per cent. had more than 50. Examination of 14 boys and four girls between the ages of 10 months and 12 years showed an average of 19·7 female mites per child, 16·5 per cent. having less than six and none more than 50. On the women, 81·5 per cent. of the mites were found on the hands and wrists, including 7·5 per cent. on the palms, and 5·9 per cent. were on the elbows. In men, 63·1 per cent. were found on the hands and wrists, none on the palms, and 10·9 per cent. on the elbows. Mites were found on the palms in 27·7 per cent. of the women and 44·4 per cent. of the children ; all the children had one or more mites on the hands, and 88·8 per cent. were infested in the interdigital region. In men, women and children, the percentages of mites found on the feet and ankles were 9·2, 8·8 and 20·3, respectively. It is thus confirmed that most people infested with *Sarcoptes* harbour relatively few mites [*R.A.E.*, B **31** 65, 128], and it is shown that men and women harbour about the same numbers in similar sites, whilst children have rather more.

Brecher (G.) & Wigglesworth (V. B.). **The Transmission of *Actinomyces rhodnii* Erikson in *Rhodnius prolixus* Stål (Hemiptera) and its Influence on the Growth of the Host.**—*Parasitology* **35** no. 4 pp. 220–224, 18 refs. London, 1944.

The symbiont of *Rhodnius prolixus*, Stål, studied by Wigglesworth [*R.A.E.*, B **24** 155–156] has been found to be *Actinomyces rhodnii*. An account is given of experiments in which it was isolated regularly from *R. prolixus* reared in the laboratory. It was not transmitted through the egg, but was taken up by the young nymphs from the contaminated surface of the egg or from the dry excreta of other bugs. Individuals reared free from *Actinomyces* by sterilising the surface of the egg and feeding them with suitable precautions, grew and moulted normally until the fourth or fifth instar, but few became adult and those that did were almost certainly incapable of reproduction. Normal growth and moulting and egg production were resumed if the bugs were infected with *A. rhodnii*. The symbiont was also isolated from *Triatoma infestans*, Klug, in the laboratory. It is thought probable that recent loss of cultures of *T. rubrofasciata*, Deg., and *T.* (*Eutriatoma*) *flavida*, Neiva, through the failure of the fifth-instar nymphs to moult was due to accidental sterilisation of the culture. Micro-organisms were absent from smears of the stomach contents of

the last remaining nymphs of *T. rubrofasciata* that had failed to moult although fed many times. Nymphs of *T.* (*E.*) *sordida*, Stål, that had failed to moult although fed repeatedly from October 1942 until February 1943, began to do so after blotting paper saturated with the infected excreta of normal bugs had been introduced into the jar and they had fed again. It is stated in an addendum that *A. rhodnii* has recently been isolated from *R. prolixus* caught in nature in Venezuela.

Friedman (R.). **Biology of** *Acarus scabiei*.—9½×6 ins., [13+] 183 pp., 112 figs. New York, N.Y., 1942. [Recd. 1944.]

About half of this book is devoted to a survey of the growth of knowledge on *Sarcoptes* (*Acarus*) *scabiei*, Deg., between 1590 and 1899, and most of the remainder consists of a summary of modern knowledge on its morphology and bionomics, based on the work of Munro [*R.A.E.*, B **7** 161] and Buxton [**9** 148; **29** 181]. All stages are described, the adults of both sexes being considered in detail. The aspects of the biology that are dealt with are the excavation of the egg burrow, oviposition, the number of eggs laid, hatching, the habits of the larvae, immature females and males and the duration of the larval and first nymphal stages.

Substitutes for scarce Materials.—*A*[*gricultural*] *W*[*ar*] *I*[*nformation*] *U.S. Dep. Agric.* no. 15, 16 pp. [Washington, D.C.] 1942. [Recd. 1944.]

This pamphlet deals with possible substitutes for some of the principal materials, now scarce in the United States owing to war conditions, normally used as insecticides against pests of plants, animals and man, or as fungicides, disinfectants, fertilisers or medicines and supplementary foods for livestock. A list of insecticidal materials is given (pp. 6-16), showing the kinds of insects against which each may be used. Under each insect entry, reference is made to the preferred substance for its control if the main entry is to an inferior one. Where the main entry is to the preferred substance, possible substitutes are shown in order of desirability.

Papers noticed by Title only.

Mazzotti (L.). **Una nueva especie de** *Ornithodoros* [*dugesi*, s.p. n.] **en Mexico.**—*Rev. Inst. Salub. Enferm. trop.* **4** no. 4 pp. 371–374, 1 pl., 1 fig. Mexico, D.F., 1943.

Schoof (H. F.) & Ashton (D. F.). **Notes and new Distribution Records on the Mosquitoes of North Carolina.**—*J. Elisha Mitchell sci. Soc.* **60** no. 1 pp. 1–10, 10 refs. Chapel Hill, N.C., 1944.

Anduze (P. J.). **La fauna culicidiana de Venezuela. Descripción de una especie nueva (Diptera : Culicidae)** [four new records in addition to a new species].—*Rev. Sanid. Asist. soc.* **7** no. 4 pp. 557–560, 1 fig., 3 refs. Caracas, 1942. [Recd. 1944.] [*Cf. R.A.E.*, B **30** 144, etc.]

Anduze (P. J.). **Huevos** [eggs] **de** *Kerteszia* **(Diptera Culicidae)** [description of the egg of *Anopheles boliviensis*, Theo., from Venezuela and supplement to the description of that of *A. homunculus*, Komp].—*Rev. Sanid. Asist. soc.* **8** no. 1 pp. 45–46, 1 fig. Caracas, 1943. (With a Summary in English.) [*Cf. R.A.E.*, B **32** 216.]

Anduze (P. J.). *Culex* (*Culex*) *beauperthuyi* **sp. nov.** (**Diptera : Culicidae**) [in Venezuela].—*Rev. Sanid. Asist. soc.* **8** no. 3 pp. 459–461, 1 fig. Caracas, 1943.

Hecht (O.). **Estudios comparativos de algunas reacciones alérgicas contra las picaduras de insectos. Experiencias obtenidas con pulgas, zancudos y simúlidos en Venezuela.** [Comparative Studies of some allergic Reactions to the Bites of Insects. Experience obtained with Fleas, Mosquitos and Simuliids in Venezuela.]—*Rev. Sanid. Asist. soc.* **8** no. 3 pp. 391–407, 19 refs. Caracas, 1943. **¿ Son todas las reacciones cutáneas contra las picaduras de insectos, chupadores de sangre, manifestaciones alérgicas ?** [Are all cutaneous Reactions to the Bites of blood-sucking Insects allergic Manifestations ?]—*T.c.* no. 6 pp. 1151–1157. (With Summaries in English.)

Cunningham van Someren (G. R.). **Some Records of Simuliidae in Abyssinia and British Somaliland.**—*Bull. ent. Res.* **35** pt. 2 pp. 113–114, 7 refs. London, 1944

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* For relation to disease, see under Anaemia (Equine Infectious), Dengue, Encephalitis, *Filaria* spp., Fowl-pox, Lymphocytic Choriomeningitis, Malaria, Tularaemia and Yellow Fever.

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ERRATA.

Page 39 7 lines from end for " (2, 2–parachlorophenyl–1, –1, 1–trichlorethane) " read " (2, 2–parachlorophenyl–1, 1, 1–trichlorethane) "

„ 118 line 15 for "[DERBENEVA-UKHOVA (B.P.).] " read "[DERBENEVA-UKHOVA (V.P.).]"

„ 129 13 lines from end for " Felton " read " Fellton "